PROJECT # 8
Task 1 - Traveler Information Services (TIS)

Inventory of Traveler Information Services and Commercial Opportunities in the I-95 Corridor

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1. INTRODUCTION

This Working Paper, the first in a series of six, summarizes the results of Task l-Inventory of TIS and Commercial Opportunities-of the Traveler Information Services (TIS) Project. This paper is submitted to the Project's Technical Review Committee (TRC) for review and consensus. The TRC's comments, recommendations, and assigned action items with respect to this paper will be analyzed and substantively included in the Final Report for this Project.

1.1 PROJECT OBJECTIVES

The I-95 Traveler Information Services Project is an ATIS implementation tailored to the unique needs of the Northeast Corridor. The project is designed to acquire and disseminate information on roadway traffic conditions, and other pertinent transportation information throughout the Corridor. It will utilize a variety of static and dynamic information ranging from transit schedules and call-in reports to real-time traffic monitoring data and transit status information. TIS will ingest, aggregate, and fuse these data in a database architecture that supports dissemination through a variety of communications systems and services to help travelers in the l-95 Corridor choose the most efficient transportation modes and/or routes.

This Project's objectives are:

+ To present a conceptual design and requirements for a Corridor-wide TIS.

+ To identify opportunities and principles for private/public partnering in providing traveler information services.

1.2 TASK 1 OBJECTIVES

This Task has two purposes. The first is to understand from the agency's perspectives, the needs and environments of all the facilities in each jurisdiction. The second purpose is to survey

potential business partners within the Northeast Corridor identifying those willing to invest in TIS infrastructure and operations. The Task's objectives include:

- Developing an inventory and description of current planned TIS services, systems, and technologies.
- Understanding legal and institutional issues, problems or concerns that arise during the inventory.
- Assessing the effectiveness of current TIS systems and technologies relative to their operating and maintenance costs.

1.3 TASK 1 APPROACH

Task 1 was conducted according to the following five steps:

- Conduct an inventory of existing traveler information services in the Corridor using a questionnaire survey, telephone interviews, and site visits.
- Assess needs of major constituencies for traveler information.
- Develop an issues paper.
- Conduct a survey of potential business partners, and establish commercial opportunities for TIS in the Corridor.
- Develop preliminary principles of partnership.

1.4 ORGANIZATION OF WORKING PAPER

This Working Paper is organized to follow the logical flow of the steps listed above.

Section l-Introduction-provides an overview of the project's and this Task's objectives and methodology.

Section 2-Current and Planned Traveler Information Services-establishes functional, technical, and financial baseline information on all traveler information services, systems, and technologies operating or under design along the l-95 Corridor.

Section 3-Needs Assessment-assesses the needs to be met by traveler information services in the Corridor.

Section 4-Challenges and Issues-discusses the challenges and issues facing the development of Corridor traveler information services.

Section 5-Preliminary Principles and Scenarios for Inter-sector Partnership-presents the public agencies' and potential business partners' attitudes toward private-sector participation in traveler information services in the Corridor, and develops preliminary "Principles of Partnership" and scenarios for private-sector participation in Corridor TIS. This forms baseline information for the Principles for Partnership and scenarios to be further developed during Task 6.

Section 6-Site Visits-reports in detail on our visits to operating traveler information services.

2. CURRENT AND PLANNED TRAVELER INFORMATION SERVICES

One of our purposes in Task 1 was to develop an understanding of Traveler Information Services (TIS) as they exist in the Corridor today and the immediate future. The approach for achieving this purpose had three steps:

+ First, a definition of traveler information services was developed using the User Services defined by the Intelligent Transportation Society of America.

+ Next, a survey was designed to capture the state of the practice, and was sent to members of the Coalition.

+ The survey was then used as a method for focusing interviews with public agencies in determining the level of TIS deployments within the Corridor.

The raw data from the survey served as input for developing an initial assessment of various technologies supporting TIS, and for generalizing the effectiveness of TIS deployments. The end result of this survey process offers valuable insight into the extent of TIS deployment in the Corridor.

This section is organized into four subsections. The first subsection is introductory and describes the preliminary definition of TIS and the survey instrument used for this task. The next subsection reports the findings of the survey which are organized around the various traveler information services. In the next subsection, the various technologies used in the deployments are examined, once the framework of TIS is set. The final subsection concludes with an examination of the cost-effectiveness of the TIS deployments. Both the technology assessment and the cost-effectiveness analysis are the subject of later tasks in this project. What is reported in this document are perceived benefits and drawbacks to TIS technology deployments.

2.1 DEFINING TRAVELER INFORMATION SERVICES

The first step in developing an estimate of TIS deployments in the Corridor involves developing a working definition of what services constitute TIS. Because the notion of User Services is well known throughout the Intelligent Transportation Systems (ITS) community, they were selected as suitable framework for defining TIS. This definition is merely a project starting point, not a target. As effort on this project continues, the definition will be refined.

Based on the definition of ITS User Services as a point of reference, a survey targeted at the public sector was designed. The survey was distributed to each member of the I-95 Corridor Coalition Steering Committee. The various Steering Committee members then identified individuals within their organizations as our point of contact for gathering survey information. We also augmented the information gathered from public agency contacts in the Corridor with information from other public agencies who may have an interest in a successful TIS deployment. Examples of these extra agencies include transit agencies and airport authorities. A list of survey participants is provided in Appendix A. The survey itself is in Appendix B.

At the highest level, TIS promotes the efficient movement of people, goods, and services by providing the suite of functions that collect, process, and communicate transportation information to the traveling public. In this definition, the term “collect information” describes the function of receiving information rather than raw data. For example, collecting of raw loop data is not a TIS function, but collecting higher-level data such as link travel times is a potential TIS function. The “term process” information refers to the function of providing additional value to collected information. An example of this might be using link travel times for developing estimates of the future state of the transportation network. Finally, “communication of travel information” is the capability of disseminating processed information to the traveling public. Essentially, TIS is a traveler’s decision support system that aids in making intelligent travel decisions at the time and location where these decisions are made.

In total, 29 User Services have been defined and grouped into six categories. The following paragraphs examine potential functionality that may conceivably be fulfilled by TIS. The focus of this discussion is to identify the functions that are clearly TIS, those that are not, and the gray areas.

2.1.1 Travel and Traffic Management

The Travel and Traffic Management group of User Services represents those services with the highest application of TIS functions. The User Services that are a member of this group and their relationship to TIS is provided in Table 2-1. The focus of this group is on increasing the operational efficiency of the transportation network. As the name implies, there are two thrusts to this group of services:

+ The first is managing the transportation infrastructure and capacity. The User Services most involved with supply are Traffic Control, Incident Management, and Travel Demand Services. These services are frequently referred to as traffic management services.

+ The remaining services focus on managing transportation demand. These services manage demand by receiving information from the traffic management services, processing that information, and delivering it to users. The thrust of these services is to influence demand by providing accurate information to users at the place and time that travel decisions occur.

Table 2-1. Travel and Traffic Management Services Application to TIS

Service Category	User Service	TIS Application
Travel and Traffic Management	Pretrip Travel Information	TIS Function
	En Route Driver Information	TIS Function
	Route Guidance	TIS Function
	Ride Matching and Reservation	TIS Function
	Traveler Services Information	TIS Function
	Incident Management	TIS Support
	Traffic Demand Management	TIS Support
	Traffic Management	TIS Support
	Emissions Testing and Mitigation	No Application

These services are intended to work in concert. They are closely coupled with TIS, where TIS either supplies or requires a critical element of information to or from the service. For example, the output of the control system is a useful input to route guidance, and output from route guidance is a useful input to a traffic control system.

The *Pretrip Travel Information* and *En Route Driver Information* services provide travelers with real-time transportation information for making travel decisions at the point where these decisions are made. These services provide information such as traffic conditions, incidents, construction, transit schedules, and other mode choice options as a method for influencing transportation demand. The traveler uses this information for making selections such as mode choice, departure time, and route. These services require input from the Traffic Control, Incident Management, and Travel Demand Management Services to generate travel information. Both of these services fall entirely within the domain of TIS.

The *Route Guidance* service aids travelers in reaching their destination. This service generates a route based on the traveler-provided origin and destination, current traffic conditions, traveler preferences, and weather conditions. This service also is entirely a TIS function.

The *Ride Matching and Reservation* function has two purposes. First, it reduces the number of single-occupancy vehicles by providing real-time, tide-sharing information. Second, it promotes more effective decision making by transportation providers by assisting with vehicle assignment and scheduling. This service is entirely a TIS function that furnishes information to both travelers and transportation providers.

The *Traveler Services Information* service is the frequently described “Yellow Pages” component of ITS. This service provides travel-related information to travelers. It, too, is entirely a TIS function.

The *Travel Demand Management* service develops strategic policies for reducing negative environmental and societal impacts caused by the transportation system. Closely related to Travel Demand Management is the *Traffic Control* service that is responsible for the integrated, adaptive control of freeway and surface streets. Traffic Control optimizes traffic flow based on current traffic conditions, weather, and anticipated demand. Traffic Control can be thought of as the tactical arm

of Travel Demand Management as it executes the day-to-day tactics to realize the objectives set by Travel Demand Management. TIS is an important partner to both of these services in that it supplies current and future transportation demand information. TIS also receives information from these services that is required for developing traveler information.

The *Incident Management* service minimizes the impact of incidents on the operation of the transportation network by detecting, verifying, and resolving incidents as quickly as possible. Incident Management notifies TIS of incidents and their current status. TIS supports Incident Management by providing capabilities needed by emergency vehicles: for example, route guidance and en-route driver information.

The new user service, *Emissions Testing and Mitigation,* measures air quality and develops strategies to mitigate air quality problems related to transportation. Its relationship to TIS is indirect; air quality data are used by Travel Demand Management which then affects TIS.

2.1.2 Public Transportation Management

This group of User Services centers around applications that promote the efficient use of public transit assets. The fundamental objective of these services is to increase intermodalism by improving short distance public transit levels of service. Table 2-2 lists these services and summarizes the level of TIS involvement with these services.

The Public *Transportation Management* service provides automated support for monitoring, operating, and planning for public transit systems. It provides transit information, such as schedule adherence, to TIS for trip planning purposes. It would be useful to Public Transportation Management to receive ridership demand forecasts based on TIS-generated itineraries. Livery transit services could conceivably plan trips based on TIS-supplied inputs.

En Route Travel Inforrnation is primarily real-time information available in public transit vehicles, depots, and transfer points. This service is very similar to En Route Driver Information and will likely share many of the same technologies.

Table 2-2. Public Transportation Management and Emergency Management Services' Relationships with TIS

Service Category I	User Service	TIS Application
Public Transportation Management	En Route Transit Information	TIS Function
	Public Transportation Management	TIS Support
	Personalized Public Transit	TIS Support
	Public Travel Security	No Application
Emergency Management	Emergency Notification and Personal Security	TIS Support
	Emergency Vehicle Management	TIS Support

The *Personalized Public Transit* service is intended to support travel requirements that cannot be satisfied through traditional fixed-route transportation. The most likely relationship to TIS is the provision of available capacity to TIS. TIS would then use this information for the purpose of developing itineraries.

The *Public Travel Security* service bears little relationship to TIS. It is primarily concerned with monitoring and maintaining a secure travel environment for travelers.

2.1.3 Emergency Management

This category is composed of two User Services, Emergency *Notification and Personal Security,* and *Emergency Vehicle Management.* Of the two, Emergency Vehicle Management is the more closely related to TIS. Emergency Vehicle Management provides three major functions, Emergency Fleet Vehicle Management, Route Guidance, and Signal Preemption. The Route Guidance function of this service is likely to use similar algorithms and technologies used for TIS and Incident Management. The likely variation will be that Signal Preemption information will be used in the development of routes. Emergency Notification and Personal Security is tangentially related to TIS. It is conceivable that applications such as mayday support may be integrated with the in-vehicle positioning techniques used for in-vehicle route guidance. These relationships are illustrated in Table 2-2.

2.1.4 Commercial Vehicle Operations User Services

This group of services is focused on the specific transportation needs of businesses that transport-people and goods for hire. The User Services contained within this group almost uniformly address needs associated with safety, assuring regulatory compliance, and credentials administration. Table 2-3 shows the relationships of these User Services to TIS. Of all of the User Services in this group, the Commercial Fleet Management service has the closest relationship to TIS. This service is composed of the information links needed for transmitting travel information. As such, it will use many TIS-provided functions.

Table 2-3. Commercial Vehicle Operations Services Relationships with TIS

Service Category	User Service	TIS Application
Commercial Vehicle Operations	Commercial Vehicle Electronic Clearance	No Application
	Automated Roadside Safety Inspection	No Application
	Commercial Vehicle Administrative Process	No Application
	On-board Safety Monitoring	No Application
	Hazardous Material Incident Response	No Application
	Commercial Fleet Management	TIS Support

2.1.5 Electronic Payment and Advanced Vehicle Safety Systems

These two groups of services are taken together because they generally consist of functions dependent on in-vehicle sensors. As shown in Table 2-4, they have very little direct TIS relationship and are presented here for completeness. There is one potential application of Electronic Payment to TIS. Potentially, those services used for automated toll payment could be shared as a currency medium for TIS. Another potential relationship to TIS is that the location of areas with infrastructure support for these in-vehicle services would be a an input to TIS.

Table 2-4. Electronic Payment and Advanced Vehicle Safety Systems' Relationships with TIS

Service Category	User Service	TIS Application
Electronic Payment	Electronic Payment Services	TIS Support
Advanced Vehicle Safety Systems	Longitudinal Collision Avoidance	No Application
	Lateral Collision Avoidance	No Application
	Intersection Collision Avoidance	No Application
	Vision Enhancement for Crash Avoidance	No Application
	Safety Readiness	No Application
	Precrash Restraint Deployment	No Application
	Automated Vehicle Operation	No Application

2.2 THE TIS INVENTORY

This section presents the results obtained from the TIS questionnaire respondents. The survey was designed to answer the following questions:

+ What traveler information is collected and disseminated?
+ Who receives that information?
+ How do they receive it?
+ Where are services offered?

Specifically, functional information includes the service's:

+ Goal or purpose.
+ User need(s) being fulfilled.

+ Primary user group(s).

+ User response.

Technical information includes the service's:

+ Operational status.

+ Reliability.

+ Geographical range.

+ User-friendliness.

+ Compatibility with other systems.

+ Overlap with other systems.

+ Customer acceptance.

Financial information includes the service's:

+ Capital and operating costs.

+ Revenue generated.

+ Opportunities for revenue-generating partnerships.

Information on existing and planned TIS capabilities is summarized as follows:

+ Summary of existing and planned traveler information dissemination devices.

+ Summary of existing or planned traveler information services.

+ Service descriptions and a Service/Technology Matrix.

See Appendix C-Public Agency Survey Results--for a complete summary of the TIS inventory questionnaire results.

TIS systems inventory questionnaires were sent to all 37 Coalition member agencies, 3 selected transportation agencies, and 3 other agencies. See Appendix A for a complete list of public-agency points of contact, and Appendix B for a copy of the TIS questionnaire. Of the 37 Coalition member agencies, only 26 operate transportation facilities. The 11 other organizations, such as the Federal Highway Administration and the Intelligent Transportation Society of America, do not operate traveler information systems. Thus, of the 37 Coalition members, only 26 could potentially respond to the TIS inventory questionnaire. The selected transportation agencies surveyed comprised the Southeastern Pennsylvania Transit Authority (SEPTA), the New Jersey Transit Corporation, and the Philadelphia International Airport (PHL). In addition, since JFK, LaGuardia, and Newark airports are operated by the Port Authority of New York and New Jersey, a Coalition member, their results were reported as well. Finally, the other agencies surveyed comprised the Montgomery County, Maryland, Traffic Management Center, SmartRoute Systems, and the Virginia Department of Tourism. These agencies were selected because they expressed an interest in participating or because they have advanced traveler information system capabilities. Altogether, 26 agencies responded, for an overall return rate of 81%. See Table 2-5 for a summary of respondents by category.

Table 2-5. Summary of Respondents

Category	Number of Respondents	Number Surveyed	Percentage Complete
State departments of transportation	11	14	76%
Transportation authorities	9	12	**75%**
Other transportation agencies	**3**	**3**	100%
Others	**3**	**3**	100%
Total	**26**	**32**	**81%**

The information summarized in Table 2-5 is based on responses received to date. As of December 16, the Loral Team was still receiving inputs from a number of solicited agencies. Additional responses received after submission of the deliverable will be included in the Final Report.

2.2.1 Summary of Existing and Planned Traveler Information Dissemination Devices

Tables 2-6 and 2-7 summarize the traveler information dissemination technologies either currently in use or planned to be in use in the I-95 Corridor. Table 2-6 summarizes the information reported by the departments of transportation and transportation authorities, and Table 2-7 summarizes information reported by the other agencies.

The most widely used traveler information dissemination mechanism is the telephone. Seventy-three percent of respondents (19 out of 26) provide some form of information to travelers over the telephone. Information provided by departments of transportation and authorities over the telephone includes construction, real-time incidents or congestion, and road-related weather conditions. Information provided by other agencies includes static schedule, route, and fare data. Only in one instance was real-time information provided by another agency: the Philadelphia International Airport provides access over the telephone to real-time arrivals and departures of all flights.

2.2.1.1 Summary of Telephone Information Available to the Public via Traveler "Hot Lines"

Table 2-8 identifies a comprehensive list of traveler information telephone "hot lines" for weather and road condition information. In some cases, the numbers listed are only available from within the associated state. Generally, the numbers that provide construction information are updated less frequently than numbers that provide traffic-related information. Construction numbers are normally updated daily or weekly. Traffic-related information is updated either on an as-needed basis or regularly at intervals ranging between 2 minutes to 1 hour. A range of techniques is used to provide information: human attendant; recording; or audiotex (Touch-Tone menus). In most cases, a user can get to an operator when phone menus are used.

Our team sent surveys to several major transit and airport agencies in the Corridor. All of the responding agencies have numbers for static information such as schedules, routes, and fares. In addition, some of the more advanced airports have numbers to call to get the real-time status of arrivals and departures via a Touch-Tone phone. See Table 2-9 for information available from selected transportation agencies.

Table 2-6. Corridor TIS Output Device Summary

Agency	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-In Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports	Others-Press (e.g Newspapers)	Others-Vertical Scrolling LEDs
DC DPW		P							E	E					
Del DOT	EP	E													
Auth	EP	EP	E												
DRPA															
Maine DOT	E			E					E	E					
Maine TA	E									E					
Md SHA	EP	EP				P				E					
Md TA	E	E				EP			E	E					E
Mont TMC	EP	E		E			E	E	E	P	P	P	E		
NH DOT		E								E					
NJHA	E			E						E					
NJ DOT										E					
NJTA	E	EP								E					
NYC DOT															
NY DOT	E	EP					E			E	E				
PA NY&NJ	EP	E		E		E			E						
Penn DOT	E	EP		E						E			E		
Penn TC	E	E		E		EP				E	P		E	E	E
RI DOT	EP			E	E				E	E	P		E		
SmartRoute				E	E	E	E		E	E					
TBTA															
VA Dept of Tourism											E				
VDOT	EP	E					E			E			E		

Note: E is for existing and P is for planned. Also, no agency currently uses either in-vehicle monitors/displays or any type of hand-held device or lap top for dissemination. Chart is based on responding agencies only.

Table 2-7. Corridor TIS Output Device Summary (other agencies)

Agency	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-In Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports	Others-Press (e.g Newspapers)	Others-Vertical Scrolling LEDs
NJ Transit	P					P				E		P			
Phil Int Air		E				E				E					E
SEPTA	E									E		E			

Note: E is for existing and P is for planned. Also, no agency currently uses either in-vehicle monitors/displays or any type of hand-held device or lap top for dissemination. Chart is based on responding agencies only.

2.2.1.2 Information Available from VMS and HAR Installations

Nearly all agencies either currently provide or have plans to provide traveler information via Variable Message Signs (VMS) or Highway Advisory Radio (HAR). Sixty-five percent of agencies (17 out of 26) currently use VMS, while 54% (14 out 26) use HAR. Incident locations, construction summaries, real-time link status, parking locations, parking availability, travel advisories, and alternate routes all were reported to be provided over VMS or HAR devices. Although VMS and HAR are considered to be TIS components, I–95 Project 9—Coordinated VMS/HAR System—has conducted more extensive inventories and analysis in these areas. In an effort to avoid duplication, this project has minimized the amount of VMS/HAR research in the Corridor. Although the collection of detailed information with respect to VMS/HAR capabilities was minimized in our survey, some respondents nonetheless provided information. This information was synthesized with that available from Project 9 to help put in perspective all TIS capabilities.

Table 2-8. Traveler Information Hot Lines for Road Conditions

State	Telephone Number	Traveler Information Provided	Type
Connecticut	203 594–3447	Road surface condition, congestion, incidents, construction sites. Available 24 hours a day.	Attendant
D.C. DPW	202 244–9594 301 718–4949	Construction sites, congestion, road surface condition. Information comes from Metro Traffic Networks—encouraged to listen to TV/radio.	Attendant
Maine	207 287–2171	Construction information for non-turnpike roads.	Attendant
Maine	207 287–3427	Road condition information for non-turnpike roads.	Attendant
Maine Turnpike	800 675–PIKE	Construction sites, congestion, road surface condition, incidents, and weather.	Recording
Maryland	410 333–1215 800 543–2515	Road surface condition, incidents, construction site.	Attendant
Maryland	800 327–3125	Information available during winter only. Year-round use planned—in the testing phase now.	Recording
Maryland State Police Barrack "M"	410 575–6540	Major incidents, congestion along I–95 .	Attendant
Massachusetts (*SmarTraveler*)	617 374–1234	SmartRoute Touch-Tone recorded selection provided for route-specific information—road condition, incidents, congestion, construction, and transit delays.	Audiotex
New Hampshire	603 271–6900	Construction sites, road and weather conditions, congestion, incidents.	Recording
New Jersey Turnpike	800 336–5875 (800 33–NJTPK)	Construction sites, congestion, road surface condition, incidents. Also HAR: AM 1610 and 590 kHz.	Audiotex
New Jersey	908 727–5929 (908 PARKWAY)	Construction sites, congestion, road surface condition, incidents (for GSP).	Recording
New York	516 952–2044 800 ROADWORK	Construction information only. 800 number only available in New York.	Audiotex
Pennsylvania Turnpike	717 939–9551	Weather-related road condition, congestion, contruction sites, and incidents.	Recording
Rhode Island	401 277–2468	Construction sites.	Attendant
Rhode Island	401 738–1211	Weather report.	Recording
Vermont State Police	800 ICY–ROAD	Weather-related road conditions during winter only.	Recording
Virginia	800 367–ROAD	Weather-related road condition, congestion construction sites, and incidents.	Attendant

Delaware DOT and Delaware Turnpike do not have hot lines.

Table 2-9. Traveler Information Hot Lines for Other Transportation Agencies

Agency	Telephone Number	Traveler Information Provided	Type
Amtrak	800 USA-RAIL	Schedule/fare/route and delay data.	Attendant
SEPTA	215 580-7800	Schedule/route/fare and special event data.	Recording and attendant
Phila. Int'l Airport	800 PHL-GATE	Information regarding real-time airline arrival and departure times, gate assignments, and other airline information.	Audiotex
Logan Int'l Airport	800 23-LOGAN	24 hours schedule and fare information for all public transportation to airport.	Audiotex
Newark Int'l Airport	800 AIR-RIDE	For general information and information on ground transportation.	Audiotex
Newark Int'l Airport	201 961-6000	Current parking, road status information, directions, paging, reservations, ground transportation to airport.	Audiotex
Baltimore-Wash. Int'l Airport	800 GO-TO-BWI	Parking and ground transportation.	Audiotex
Baltimore-Wash. Int'l Airport	800 I-FLY-BWI	Paging, parking, ground transportation and general information.	Audiotex
LaGuardia Airport	718 5333400	Current parking, road status information, directions, paging, ground transportation to airport.	Human; audiotex early '95
J. F. Kennedy Int'l Airport	718 244-4444	Current parking, road status information, directions, paging, ground transportation to airport.	Attendant

Following telephone, VMS, and HAR, faxes are the next most widely used dissemination mechanism. Faxes were reported to be used mostly for relaying construction and incident information to other public agencies or private-sector dissemination companies, not directly to travelers.

Interfaces to public radio stations, the use of public kiosks, and commercial traffic reports were the next three most widely used dissemination mechanisms. Direct interfaces to public radio stations (e.g., voice or data relay of incident and construction information via a direct connection) or indirect interfaces to radio stations via a commercial traffic reporting firm were reportedly used in a

few locations in the Corridor. Data gathered from the private-sector questionnaire as well as site visits to Shadow Broadcasting Services and Metro Traffic Network reveal that information provided to commercial traffic reporting firms has probably been underreported. This is especially true given that commercial traffic reporting firms have existing operations in nearly every major city in the Corridor (see Section 5 for a description of commercial traffic report firms and their locations). This underreporting can be attributed to the loose coupling that exists between private traffic reporting firms and public agencies. Normally, informal working relationships exist (not explicit or contractual relationships) and only telephone calls are used to exchange information. See Section 5 for commercial traffic reporting firms' survey results and Section 6 for reports of our site visits to Shadow Broadcast Services and Metro Traffic Networks. Finally, public kiosks and travel boards are in use in a several public locations (e.g., rest stops, airports, etc.) in the Corridor. These devices are used to provide an array of information from road weather and traffic conditions to tourist attractions.

In conclusion, two additional figures are provided as follows:

+ Figure 2-I provides a prioritized summary of TIS dissemination technologies either currently in use or planned to be used by responding Coalition member agencies. The prioritization does not necessarily reflect the relative importance or effectiveness of each device, but rather the amount of agencies that currently use or have plans to use that device.

+ The attached AutoCAD map graphically displays all of the various TIS capabilities throughout the Corridor. It is intended to provide the general location of services provided. In addition to public agency services, the map also identifies the location of commercial traffic reporting firms.

2.2.2 Summary of Existing and Planned Traveler Information Services

This section addresses services in the I-95 Corridor. In addition to this summary, see Appendix E for an updated list of advanced traveler information projects in the Corridor and the United States.

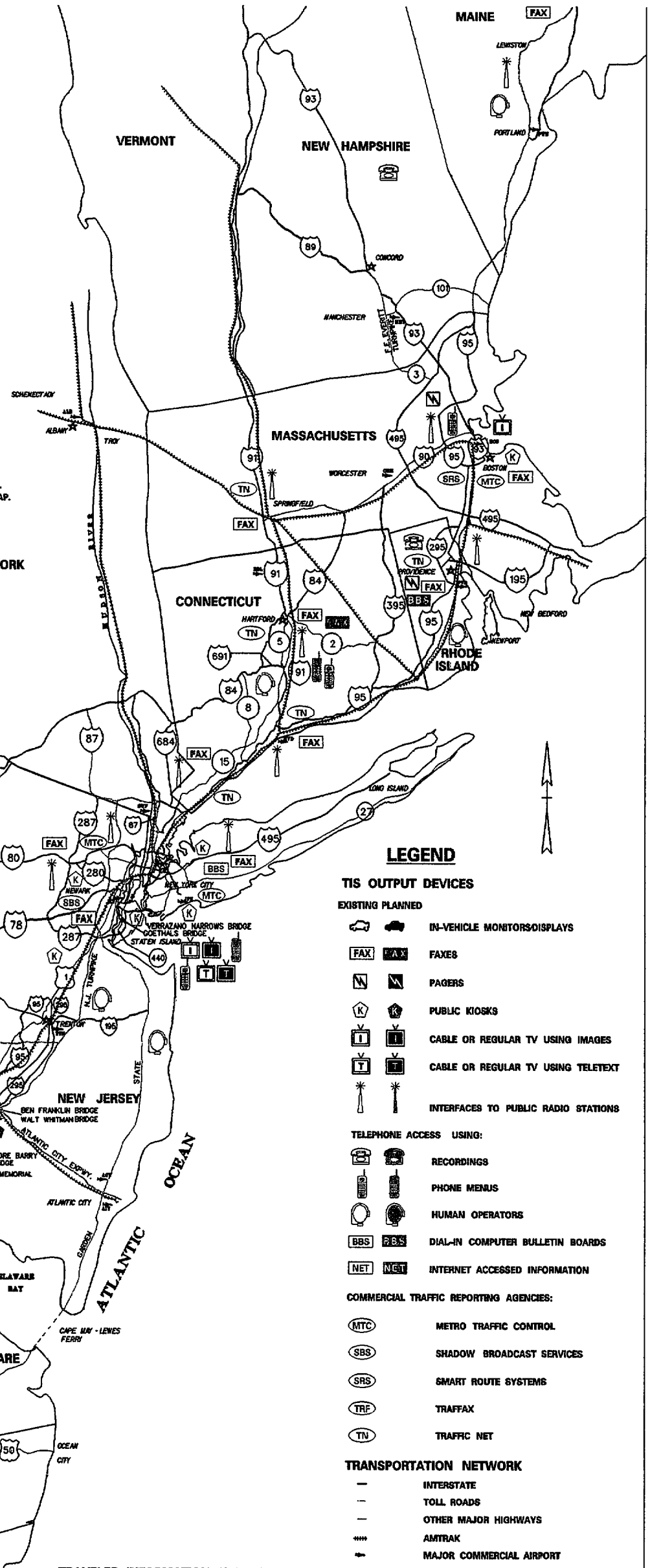
EXISTING AND PLANNED TRAVELER INFORMATION SERVICES

I–95 CORRIDOR COALITION

Connecticut DOT
Delaware DOT
District of Columbia Dept. of Public Works
Maine DOT
Maryland DOT
Massachusetts Highway Department
New Hampshire DOT
New Jersey DOT
New York City DOT
New York State DOT
Pennsylvania DOT
Rhode Island DOT
Vermont Agency for Transportation
Virginia DOT
Delaware River and Bay Authority
Delaware River Port Authority
Delaware Turnpike Administration
Maine Turnpike Authority
Maryland Transportation Authority
Massachusetts Turnpike Authority
New Jersey Highway Authority
New Jersey Turnpike Authority
New York State Thruway Authority
Pennsylvania Turnpike Commission
Port Authority of New York & New Jersey
Triborough Bridge and Tunnel Authority
AAA Foundation for Traffic Safety
Amtrak
ATA Foundation
American Bus Association
Federal Highway Administration
Federal Railroad Administration
Federal Transit Administration
IVHS America
National Private Truck Council
Transcom
USDOT Office of Intermodalism

NOTES

1. SCALE ON MAP DOES NOT ENSURE PRECISION IN LOCATION AND QUANTITY OF TIS DEVICES.
2. HAR AND VMS ARE NOT SHOWN ON THIS MAP. REFERENCE PROJECT 9.



LEGEND

TIS OUTPUT DEVICES

EXISTING PLANNED

- IN-VEHICLE MONITORS/DISPLAYS
- FAXES
- PAGERS
- PUBLIC KIOSKS
- CABLE OR REGULAR TV USING IMAGES
- CABLE OR REGULAR TV USING TELETEXT
- INTERFACES TO PUBLIC RADIO STATIONS

TELEPHONE ACCESS USING:

- RECORDINGS
- PHONE MENUS
- HUMAN OPERATORS
- DIAL-IN COMPUTER BULLETIN BOARDS
- INTERNET ACCESSED INFORMATION

COMMERCIAL TRAFFIC REPORTING AGENCIES:

- MTC — METRO TRAFFIC CONTROL
- SBS — SHADOW BROADCAST SERVICES
- SRS — SMART ROUTE SYSTEMS
- TRF — TRAFFAX
- TN — TRAFFIC NET

TRANSPORTATION NETWORK

- INTERSTATE
- TOLL ROADS
- OTHER MAJOR HIGHWAYS
- AMTRAK
- MAJOR COMMERCIAL AIRPORT

TRAVELER INFORMATION HOT–LINES

STATE	PHONE #	TRAVELER INFO PROVIDED
CONNECTICUT	203–594–3447	ROAD SURFACE CONDITION, CONGESTION, INCIDENTS, CONSTRUCTION SITES.
DCDPW	202–244–9594 301–718–4949	CONSTRUCTION SITES, CONGESTION, ROAD SURFACE CONDITION
MAINE	207–287–2171 207–287–3427	CONSTRUCTION INFORMATION FOR NON–TURNPIKE ROADS ROAD SURFACE CONDITIONS FOR NON–TURNPIKE ROADS
MAINE TURNPIKE	800–675–PIKE	CONSTRUCTION SITES, CONGESTION, ROAD SURFACE CONDITION, INCIDENTS AND WEATHER
MARYLAND	410–333–1215 800–543–2515	ROAD SURFACE CONDITION, INCIDENTS, CONSTRUCTION SITE
MARYLAND	800–327–3125	RECORDED ROAD CONDITON INFORMATION AVAILABLE DURING WINTER ONLY.
MARYLAND STATE POLICE BARRACKS	410–575–6540	MAJOR INCIDENTS, CONGESTION ALONG I–95
MASSACHUSETTS (SmartTraveler)	617–374–1234	SMART ROUTE TOUCHTONE RECORDED SELECTION PROVIDED FOR ROUTE–SPECIFIC INFORMATION–ROAD CONDITION, INCIDENTS, CONGESTION, CONSTRUCTION AND TRANSIT DELAYS.
NEW HAMPSHIRE	603–271–6800	CONSTRUCTION SITES, ROAD AND WEATHER CONDITIONS, CONGESTION, INCIDENTS.
NEW JERSEY	800–336–5875 (800–33NJTPK)	CONSTRUCTION SITES, CONGESTION, ROAD SURFACE CONDITION, INCIDENTS.
NEW JERSEY	908–727–5929 (908–PARKWAY)	CONSTRUCTION SITES, CONGESTION, ROAD SURFACE CONDITION, INCIDENTS (FOR GSP).
NEW YORK	800–ROADWORK	CONSTRUCTION SITES
PENNSYLVANIA TURNPIKE	717–939–9551	WEATHER RELATED ROAD CONDITION, CONGESTION CONSTRUCTION SITES AND INCIDENTS.
RHODE ISLAND	401–277–2488 401–738–1211	CONSTRUCTION SITES WEATHER REPORT
VERMONT	800–ICY–ROAD	WEATHER RELATED ROAD CONDITIONS DURING WINTER ONLY.
VIRGINIA	800–367–ROAD	WEATHER RELATED ROAD CONDITION, CONGESTION, CONSTRUCTION SITES AND INCIDENTS.
AMTRAK	800–USA–RAIL	SCHEDULE F

Tables 2-10 and 2-11 summarize the traveler information services either currently in use or planned to be in use in the I-95 Corridor. Table 2-10 provides information reported by the various departments of transportation and transportation authorities, while Table 2-11 provides information reported by the surveyed transit agencies. From observation of these tables, it is clear that the most widely supported traveler information service is providing construction summaries: 91% of responding agencies provide this service. Only 2 out of 23 highway agencies do not attempt to provide construction information to travelers.

The next most supported traveler information service is providing real-time incident and congestion summaries: 17 of the responding agencies reported that they provide information in this area. Interestingly, this is consistent with the findings in Task 1 of the Project 3 Surveillance Requirements and Technology, where the most important overall surveillance goal was to enhance traffic incident management, and the most important associated objective was to provide data for automated incident detection. Similarly, the goal of supporting TIS was ranked 5th in that survey. The objective of providing traffic condition information (e.g., incidents, congestion) to travelers, however, was the highest ranked objective to support the TIS goal.

Table 2-10. Corridor TIS Service Summary

Agency	R/T Incident/Cong	Construction Summ.	R/T Link Status	Parking Location	Parking Availability	Road Weather Cond.	Travel Advisories	Alternate Routes	Trip Plans	Route Guidance	Static data-Bus	Static data-Air	Static data-Train	Static data-Subway	Static data-Ship	R/T data-Bus	R/T data-Air	R/T data-Train	R/T data-Subway	R/T data-Ship	ParaTransit Services	Ride-Matching	Lodging Info	Special Events	Regional Weather Cond.	Food/Dining & Gas Info	Safety Info	Regional Env. Cond.
DC DPW	E	E				E																						
Del DOT		E						E																				
DRBA	E	E																										
DRPA																												
Maine DOT	E	E				E	E	E																				
Maine TA	E	E		E	E	E	E																	E				
Md TA		P		E	E	E	E			P													P	E	E	P		E
MD SHA	E	E				E																						
Mont TMC	P	E				P										E												
NH DOT	E	E				E																						
NJ DOT	E	E				E																						
NJHA	E	E																						E				
NJTA	E	E				E	E	E	E	E																		
NYC DOT																												
NY DOT	E	E	E																									
PA NY&NJ		E					E				E		E	E	E			E			E	E	E			E		
Penn DOT	E	E					E														E							
Penn TC	P	E				P																	P		E			
RI DOT	P	P	E	E		E	P	P			E		E											E				
Smart Route (SRS)	E	E	E			E	E	E			P	P	P	P	E	E	E	E	E	E				E				
TBTA																												
Tourism		E					E																E			E		
VDOT	E	E				E																						

Note: E is for existing and P is for planned. Chart is based on responding agencies only.

The third and fourth most supported services are road weather conditions and travel advisories. Several agencies in the Corridor have telephone numbers to call to get road-specific weather conditions (e.g., Vermont, Pennsylvania Turnpike Commission, Maryland, Maine, New Hampshire, New Jersey, Rhode Island, and Massachusetts). Moreover, several jurisdictions (e.g., parts of D.C., Maryland, Pennsylvania and New York) have deployed or will be deploying Road

Weather Information Systems (RWIS). These systems, normally instrumented with Surface Condition Analyzer (SCAN) sensors, provide information on road surface conditions (e.g., temperatures, dry, wet, ice spots).

Table 2-11. Corridor TIS Service Summary (other agencies)

Agency	R/T Incident/Cong	Construction Summ.	R/T Link Status	Parking Location	Parking Availability	Road Weather Cond.	Travel Advisories	Alternate Routes	Trip Plans	Route Guidance	Static data-Bus	Static data-Air	Static data-Train	Static data-Subway	Static data-Ship	R/T data-Bus	R/T data-Air	R/T data-Train	R/T data-Subway	R/T data-Ship	ParaTransit Services	Ride-Matching	Lodging Info	Special Events	Regional Weather Cond.	Food/Dining & Gas Info	Safety Info	Regional Env. Cond.
NJ Transit				P	P				P		E		E	E		P		P	P									
PHL	E	E		E	E	E					E	E	E				E	E					E					
SEPTA									E		E		E	E		P		P	P									

Note: E is for existing and P is for planned. Chart is based on responding agencies only.

Providing information on bus and train schedules/routes/fares, lodging, real-time bus and train locations, parking locations, and alternate routing were moderately supported by responding agencies.

Not one agency provides information on *road specific* environmental conditions and only one reported providing information on *regional* environmental conditions. The lack of environmental information is consistent with findings of Project 3-Surveillance Requirements and Technology. In addition, not one agency reported providing information on traveler safety. The lack of safety information is under reported, as we know that many agencies currently provide information–typically through fixed signage–on driving tips, emergency telephone locations/numbers, and travel advisories. Finally, both environmental and safety information are increasingly becoming more important to the Coalition. This is evidenced by the agencies' responses to the

questionnaires on goals from both Project 3 and the present Project (to be reported in Working Paper 2).

With respect to users, the results from surveys indicate the following user groups are the major targets of information currently provided:

+ Intercity commuters
+ Travelers/commuters
+ Public agencies
+ Commercial vehicles
+ Private companies

Results from surveys indicate the following user groups are not well supported by existing offerings:

+ Police/emergency
+ Employers
+ Intermodal operators

These conclusions were drawn based on the responses to surveys that asked for an identification of user groups for each provided traveler information service.

Figure 2-2 provides a prioritized summary of traveler information services either currently supported or planned to be supported by responding Coalition member agencies.

2.2.3 Service/Technology Matrix

In this section, a two-dimensional matrix is used to summarize TIS capability findings. Each cell in the matrix identifies a unique service/technology pair. The data in the cells identify which agencies support the service-technology pair. The notation used in each cell is agency name, followed by a colon, followed by the letters *E, P, or EP* to indicate existing, planned, or existing and planned, respectively (e.g., *PennDoT:E).*

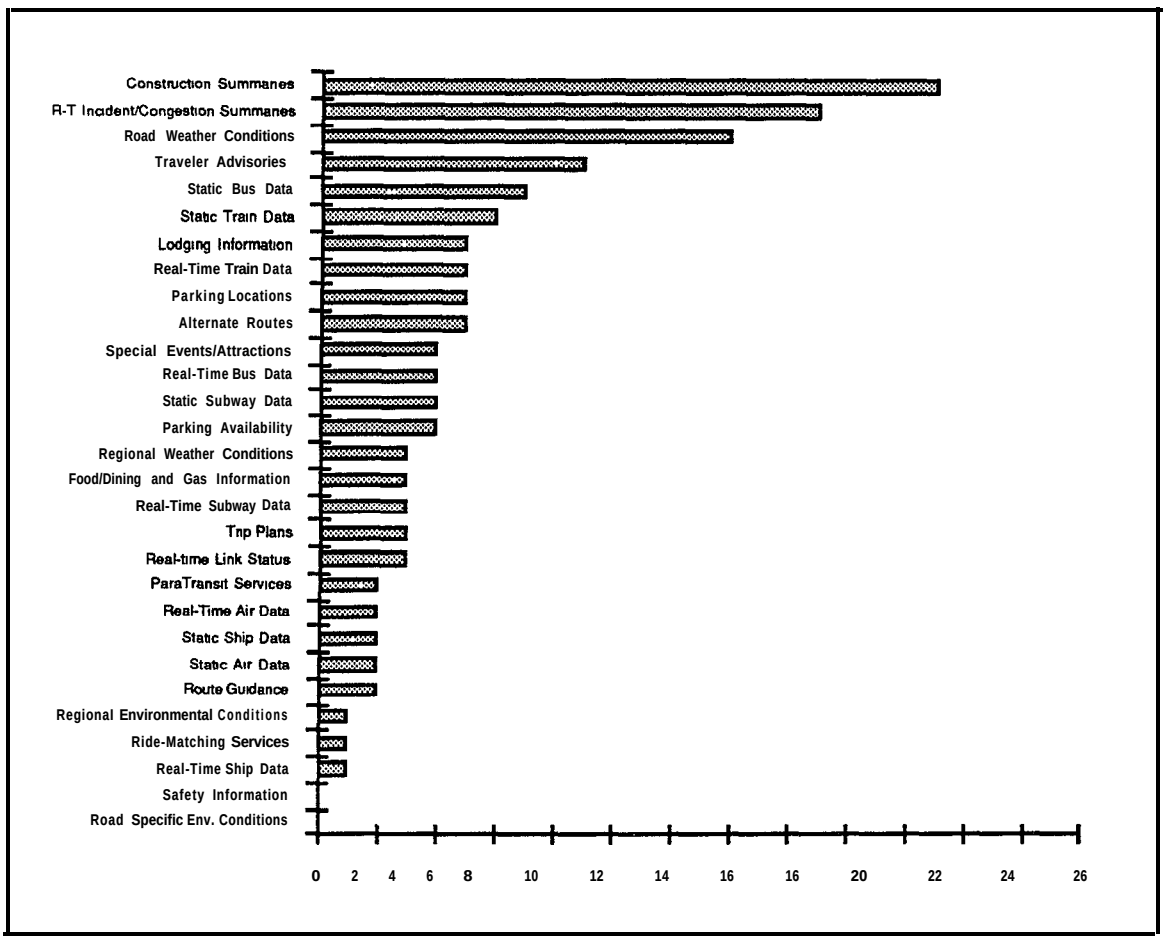


Figure 2-2. Most Widely Supported Services in the i-95 Corridor

2.2.3.1 Real-Time Incident and Congestion Summaries

This service provides accurate and up-to-date information on existing incidents on the roadway system. Incidents are any delay on the roadway system due to accidents, construction, weather conditions, system malfunctions, etc. Information includes type of incident, location, expected delay, duration, severity, lanes blocked, alternate routes, etc.

Table 2-12 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Table 2-l 6 is a legend for mapping an agency to the notation used in Tables 12-15. Over all, this was the second most widely supported service in the Corridor: nearly 74% of the agencies provide service in this area. The most commonly reported dissemination technologies to support this service are audiotex, recordings, or attendants (13 agencies); public radio stations (four agencies); variable message signs, dial-in computer bulletins, highway advisory radio, and commercial traffic reports.

2.2.3.2 Construction Summaries

This service provides locations of new, on-going, and future construction locations with respect to the roadway system. Information includes location, lanes blocked, duration, expected delay, alternate routes, etc.

Table 2-l 2 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this is the most widely supported service, as over 21 of the 23 responding highway agencies reported capabilities. The most commonly reported dissemination technologies to support this service are audiotex, recordings, or attendants (14 agencies); faxes (seven agencies); variable message signs; highway advisory radio; public radio stations; and commercial traffic reports.

The Pennsylvania Turnpike Commission, and the Virginia and New York State Departments of Transportation reported that they send construction reports to state or local newspapers.

2.2.3.3 Real-Time Link Status

This service provides information regarding the status of links with respect to the roadway system. Status is real-time, meaning that it is updated continuously on a second-by-second or minute-by-minute basis. For freeways, links are normally defined between off ramps or between detector stations. For surface streets, links are normally defined between intersections or detector stations. The status associated with a given link normally reflects a level-of-service rating (e.g., numerical or color-coded assignments) associated with a selected measure (speed, volume, travel times, measure of effectiveness, etc.).

Table 2-12. Service/Technology Matrix 1

	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-In Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports
Real-Time Incident/ Congestion	NJHA:E, Penn DOT:E, MD SHA:E, NY DOT:EP	Mont TMC:EP, Phil Int Air:E, MD SHA:E		Mont TMC:E, PTC:E, RI DOT:E	RI DOT:E, SRS:E	SRS:E, MD SHA:E	Mont TMC:E, SRS:E	Mont TMC:E	Mont TMC:E, RI DOT:E, SRS:E, DC DPW:e	Mont TMC:P, NJHA:E, RI DOT:E, SRS:E, Maine DOT:E, PTC:E, Conn DOT:E, Maine TP:E, MD SHA:E, NH DOT:E, NJTP:E, NJ DOT:E, DC DPW:E	Mont TMC:P, NY DOT:E, PTC:P, RI DOT:P	Mont TMC:P	Mont TMC:E, RI DOT:E, DC DPW:E
Construct-ion Summaries	Del DOT:E, Maine DOT:E, NJHA:E, PTC:E, NY DOT:E	Del DOT:E, Mont TMC:E, PTC:E, Phil Int Air:E, NY DOT:P		Maine DOT:E, Mont TMC:E, NJHA:E, PA NY&NJ:E, Penn DOT:E, PTC:E, RI DOT:E	RI DOT:E, SRS:E	SRS:E, Md TA:EP, MD SHA:EP	Mont TMC:E, SRS:E	Mont TMC:E	Maine DOT:E, Mont TMC:E, RI DOT:E, SRS:E, Md TA:E	Maine TA:E, Penn DOT:E, RI DOT:E, SRS:E, NH DOT:E, NJTA:E, NJDOT, NY DOT:E, PTC:E, Conn DOT:E, Maine DOT:E, MD SHA:E, VDOT:E, DC DPW:E	RI DOT:P, VA Dept of Tourism:E		Mont TMC:E, PTC:E, RI DOT:E, MDTA:E
Real-Time Link Status	NY DOT:E			RI DOT:E	RI DOT:E, SRS:E	SRS:E	SRS:E		RI DOT:E, SRS:E	RI DOT:E, SRS:E	NY DOT:E		RI DOT:E

Table 2-l 2 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, not many agencies reported having support for this service. The most commonly reported dissemination technologies to support this service are audiotex, recordings, attendants (two agencies); and pagers (two agencies). in the future, as more roads become instrumented, it is likely that this area will increase dramatically.

2.2.3.4 Parking Locations

This service provides information on locations of parking garages and spaces for a given region.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, not many agencies reported having support for this service, mostly airports. The most commonly reported dissemination technologies to support this service are: audiotex, recordings, attendants (two agencies); public kiosks (two agencies): and variable message signs or highway advisory radio (airports).

2.2.3.5 Parkina Availabilitv

This service provides information on the availability (e.g., 98% full, 2 spaces left) of parking garages and spaces.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Again, not many agencies reported having support for this service, mostly transit agencies (obviously nearly all airports). The most commonly reported dissemination technologies to support this service are: audiotex, recordings, attendants (two agencies); public kiosks (two agencies); and variable message signs or highway advisory radio (airports).

Table 2-13. Service/Technology Matrix 2

	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-in Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports
Parking Locations	NJ Transit:EP	Phil Int Air:E		RI DOT:E	RI DOT:E	Md TA:E, NJ Transit:EP			RI DOT:E	RI DOT:E, NJ Transit:EP		NJ Transit:EP	RI DOT:E
Parking Availability	NJ Transit:EP	Phil Int Air:E				Md TA:E, NJTransit. EP				NJ Transit:EP		NJ Transit:EP	
Road Weather Condition	Md TA:E, MD SHA:E	Mont TMC:E, Md TA:E, Phil Int Air:E,		Mont TMC:E	SRS:E	SRS:E, Md TA:E, MD SHA:E	Mont TMC:E, SRS:E	Mont TMC:E	Mont TMC:E, SRS:E, Md TA:E	aine TA:E, Mont TMC:P, PTC:E, SRS:E, MD SHA:E, NH DOT:E, RI DOT:E, Verm DOT E, Conn DOT.E, DC DPW.E, Maine DOT:E, NJTA:E, NJ DOT E, VDOT:E	Mont TMC:P	Mont TMC:P	Mont TMC:E
Travel Advisories	Maine DOT:E, Maine TA:E, NJTA:E, PA NY&NJ:E, Penn DOT:E, Md TA:E	PA NY&NJ:E, Md TA:E		Maine DOT:E, RI DOT:E	RI DOT:E, SRS E	PA NY&NJ E, SRS:E, Md TA:E	SRS.E		Maine DOT:E, PA NY&NJ.E, RI DOT:E, SRS:E, Md TA:E	DOT:E, SRS:E	RI DOT.P, VA Dept of Tourism:E		RI DOT.E
Alternate Routes	Del DOT:E, Maine DOT:E	Del DOT:E, NJTA.E		Maine DOT:E, RI DOT:E	RI DOT:E, SRS:E	SRS.E	SRS E		Maine DOT:E, RI DOT.E, SRS E	RI DOT:E, SRS:E	RI DOT:P		RI DOT.E
Trip Plans					SEPTA.E	SEPTA:E, NJ Transit:P				NJTA E, NJ Transit:P		NJ Transit:P	
Route Guidance	NJTA:E					Md TA.EP							

2.2.3.6 Road Weather Condition

This service provides weather information relevant to the roadway system. Information can include current road surface conditions (e.g., temperate, wet/dry/icy), driving conditions, and current and forecast area or regional weather conditions.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this was the third most widely supported service by Coalition agencies: 14 agencies provide this service. The most commonly reported dissemination technologies to support this service are: audiotex, recordings, or attendants (14 agencies); public radio stations (three agencies); public kiosks, and variable message signs or highway advisory radio.

The Pennsylvania Turnpike Commission, Maryland Transportation Authority, and Philadelphia International Airport use horizontally scrolling red Light-Emitting Diode (LED) banners to display, among other things, weather conditions.

2.2.3.7 Travel Advisories

Travel advisory information usually includes warnings based on the conditions of the roadway system. Advisory information is expected to be acted on by the travelers to avoid hazardous (safety related) or undesirable (congestion related) driving conditions. It is different from other types of information which is usually directed at promoting the travelers' situational awareness about roadway conditions or providing traveler-support services.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this was the fourth most widely supported service by Coalition agencies: nine agencies provide support for this service. The most commonly reported dissemination technologies to support this service are variable message signs (six agencies), and public radio stations (five agencies).

2.2.3.8 Alternate Routes

This service provides information to users regarding alternate routes or paths to arrive at a given destination. The alternate route is provided to avoid delays due to abnormal road conditions.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service was not very well supported: only 5 agencies reported providing support. The most commonly reported dissemination technologies to support this service are public radio stations (three agencies), and variable message signs or highway advisory radio (two agencies).

2.2.3.9 Trip Plans

This service provides detailed information to travelers that allows them to arrive at a given destination and, if necessary, return back to their origin (i.e., round trip). A trip plan can recommend various modes, travel times, routes, etc. based on the needs of the user. A trip plan is generated based on a user's origin, destination, begin time, arrival time, return time, modal preferences, constraints (cost, time, distance walked), travel conditions, weather conditions, etc.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not supported by highway agencies. All transit agencies, however, provide support for this service, as it is very important to encouraging new and maintaining existing ridership. The most commonly reported dissemination technologies to support this service are telephones (two of the three agencies), and public kiosks (two of the three agencies).

2.2.3.10 Route Guidance

This service generates a route based on the traveler-provided origin-destination. Current traffic conditions, traveler preferences, and weather conditions are taken into consideration in determining the route.

Table 2-13 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by highway agencies. Only two agencies reported providing support for this service: the Maryland Transportation Authority via public kiosks, and the New Jersey Turnpike Authority via variable message signs.

2.2.3.11 Road-Specific Environmental Conditions

This service provides environmental information relevant to the roadway system. Information can include current carbon monoxide, nitrous oxide, or particulates levels. This service is not supported by any Coalition agency.

2.2.3.12 Static Bus, Train, Subway, Ship, and Air Data

This service provides static information on a given transportation mode. Static information does not change very frequently. Information can include transit schedules, routes, fares, stops, hours of operation, etc.

Table 2-14 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. All responding transit agencies reported providing information to support the bus, train, and subway static data service. Telephone-provided information was the major dissemination technology used. SmartRoute Systems reported providing information via faxes and TV for static ship data. No transportation agency (including all surveyed airports) provides information on static air schedules--this is primarily an airline service.

2.2.3.13 Real-Time Bus, Train, Subway, Ship, and Air Data

This service provides dynamic, real-time information on a given transportation mode. Dynamic information changes frequently. Dynamic, real-time information, with respect to transit Systems, can include location, speed, arrival time, departure time, etc.

Table 2-14. Service/Technology Matrix 3

	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-In Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports
Static Bus Data										NJ Transit:E, RI DOT:E, SEPTA:E			
Static Train Data										NJ Transit:E, RI DOT:E, SEPTA:E		SEPTA:E	
Static Subway Data										NJ Transit:E, SEPTA:E			
Static Ship Data				SRS:E			SRS:E			SRS:E			
Static Air Data													
Real-Time Bus Data	NJ Transit:P					NJ Transit:P				NJ Transit:P		NJ Transit:P	
Real-Time Train Data	NJ Transit:P					NJ Transit:P, PHL:P				NJ Transit:P		NJ Transit:P	
Real-Time Subway Data	NJ Transit:P					NJ Transit:P				NJ Transit:P			
Real-Time Ship Data													
Real-Time Air Data						PHL:E				PHL:E, 800-PHL-GATE			

Table 2-14 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Only the New Jersey Transit Corporation provides real-time bus, train, and subway data. NJ Transit provides this information via variable message signs, public kiosks, telephone, and the Internet (mainly for University of Pennsylvania students). No agency reported providing real-time ship data. Lastly, real-time air data are provided by the Philadelphia International Airport. Although every airport uses some type of flight information display system, PHL was the only airport that reported use of a Multi-User Flight Information Display System (MUFIDS), where information is obtained from all airlines and centralized in an agency computer. These real-time arrival/departure data are then made available to telephone users via telephone number 800 PHL-GATE (see Section 6 for minutes of a site visit to PHL).

2.2.3.14 Paratransit Services

Paratransit, in the strictest sense, is a "modified transit" service. This mode of transportation includes carpooling, vanpooling, subscription bus, limousine service, taxi service, personalized public transportation, etc. The primary purpose of paratransit is to support travel needs that cannot be satisfied through traditional fixed-route public transportation.

This service is not well supported by the Coalition. Only one agency reported providing any type of support at all. The Port Authorities of New York and New Jersey reported that it provides this information via public kiosks.

2.2.3.15 Ride-Matching

This service identifies potential matches from a database of travelers for potential cat-pools, vanpools, etc. Matches are based on commonalties of individual travelers' characteristics (e.g., origin, destination, preferences to drive or ride, begin work time, end work time, special access requirements, etc.). Records in the database are kept private, and a user must request to have his record entered.

This service is not well supported by the Coalition. Only one agency reported providing any type of support at all. The Port Authorities of New York and New Jersey reported that it provides this information via public kiosks.

2.2.3.16 Lodging Information

This service provides lodging information, including locations, rates, hours of operation, reservations, rating, availability, etc. for a given area. Lodging information is normally included in Yellow Pages-type services.

Table 2-l 5 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the Coalition. Only a few agencies reported providing support for this service. The Maryland Transportation Authority and the Pennsylvania Turnpike Commission provide this information at service plazas via public kiosks. The Port Authorities of New York and New Jersey and the Philadelphia International Airport also provide this information inside their airports via public kiosks. The Virginia Department of Tourism provides this information via America Online.

2.2.3.17 Special Events

This services provides information on special events in a given region. Information is provided on type of event, description of event, costs, locations, ground transportation, start times, durations, etc.

Table 2-15 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the Coalition. Only four agencies reported providing support for this service: the New Jersey Highway Agency provides support via variable message signs: SmartRoute Systems (SRS) provides support via faxes, TV, and telephone; the Maryland Transportation Authority provides support via public kiosks; and the Rhode Island Department of Transportation reportedly provides support via public radio stations, telephone, and commercial traffic reports.

Table 2-15. Service/Technology Matrix 4

	VMS (Reference Project #9)	HAR (Reference Project #9)	CB/Amateur Radio	Faxes	Pagers	Public Kiosks/Travel Boards	TV using CCTV Images	TV with Teletext	Public Radio Stations	Phone Menus/Recordings/Attendants	Dial-In Computer BBs	Internet (e.g. Mosaic)	Commercial Traffic Reports
Para-Transit Services						PA NY&NJ:E							
Ride-Matching						PA NY&NJ:E							
Lodging Info						Md TA:EP,PA NY&NJ:E, PTC:P, Phil Int Air:P					VA Dept of Tourism:E		
Special Events	NJHA:E			SRS:E		Md TA:E	SRS:E		RI DOT:E	RI DOT:E, SRS:E			RI DOT:E
Regional Weather Cond.						Md TA:E				Maine TA:E, PTC:E			
Food, Dining & Gas Info						PA NY&NJ:E, Md TA:EP					VA Dept of Tourism:E		
Safety Info						Md TA:E							
Regional Env. Cond.						Md TA:E							

Table 2-16 Agency Name Legend

Key	Agency Name
Conn DOT	Connecticut Department of Transportation
DC DPW	Washington D.C. Department of Public Works
Del DOT	Delaware Department of Transportation
Maine DOT	Maine Department of Transportation
Maine TA	Maine Transit Authority
Maine TP	Maine Turnpike
MD SHA	Maryland State Highway Authority
MDTA	Maryland Transit Authority
Mont TMC	Montgomery County (Md.) Traffic Management Center
NH DOT	New Hampshire Department of Transportation
NJHA	New Jersey Highway Authority
NJTA	New Jersey Transit Authority
NJTP	New Jersey Turnpike
NY DOT	New York Department of Transportation
Penn DOT	Pennsylvania Department of Transportation
Phil Int Air	Philadelphia International Airport
RI DOT	Rhode Island Department of Transportation
SEPTA	
SRS	SmartRoute Systems
Va Dept of Tourism	Virginia Department of Tourism
VDOT	Virginia Department of Transportation

2.2.3.18 Regional Weather Conditions

This service provides current and forecast regional weather condition information, including temperature, barometric pressure, humidity, precipitation, cloud coverage, etc.

Table 2-l 5 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the

Coalition. Only a few authorities support this service. The Maryland Transportation Authority provides information via public kiosks and the Maine Turnpike and Pennsylvania Turnpike provide information via telephone.

2.2.3.19 Food, Dining, and Gas

This service provides food, dining, and gas information, including locations, rates, hours of operation, reservations, rating, etc. for a given area. Dining is distinguished from food (i.e., fast food) in that reservations, dress codes, or other special characteristics may apply. Food, dining, and gas information is normally included in Yellow Pages-type services.

Table 2-15 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the Coalition. Only a few agencies support this service: the Port Authorities of New York and New Jersey and the Maryland Transportation Authority provide information via public kiosks, while the Virginia Department of Tourism provides information via America Online.

2.2.3.20 Safety information

This service provides traveler safety information, which includes driving tips, emergency telephone locations, hospitals, repair shops, etc. Safety information is normally included under Yellow Pages-type services.

Table 2-15 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the Coalition. Only one agency reported providing support for this service: the Maryland Transportation Authority reportedly provides information via public kiosks.

2.2.3.21 Regional Environmental Conditions

This service provides environmental information relevant to a region. Information can include current carbon monoxide, nitrous oxide, or particulates levels.

Table 2-15 identifies the dissemination technologies that are currently used by or planned to be used by various agencies to support this service. Over all, this service is not well supported by the Coalition. Only one agency reported providing support for this service: the Maryland Transportation Authority reportedly provides information via public kiosks.

2.3 OVERVIEW AND PRELIMINARY ASSESSMENT OF EXISTING TECHNOLOGIES

This section examines each of the traveler information technologies currently in use in the Corridor (as reported in the surveys) and provides a preliminary assessment of their suitability in achieving the high-priority goals and objectives indicated by the member agencies in the surveys. This assessment is based on two sources:

+ Each agency's reported experience with the technology in terms of effectiveness and maintainability.

+ State-of-the-art knowledge with respect to these technologies.

Each of the technologies (as listed in Section 2.2) will in addition be compared to its scope for addressing the following high-priority goals:[1]

+ Enhance urban and interurban Corridor road travel by providing timely, accurate and Corridor-wide access to information on road conditions, including congestion,

[1] This is a preliminary prioritization based on results from the Task 2 goals survey.

accidents, construction, alternate routes, link speeds, route guidance, trip plans, and road-related weather conditions.

+ Improve environmental quality in the Corridor by reducing air pollution through minimizing peak period congestion, encouraging car pooling, increasing bus and transit ridership, and increasing the ease of transfers between modes.

+ Enhance modal and intermodal travel by providing timely, accurate, and Corridor-wide access to information on urban mass transit (urban bus, ferry, subway, light rail, commuter rail and personalized public transportation) and intercity mass transit (interurban air, ship, rail, and bus), including schedules, routes, fares, alternate modes, intermodal connections and real-time status/locations.

+ Promote TIS and induce its use to demonstrate the benefits to the public of using an ATIS.

+ Enhance the safety of travelers by providing timely, accurate, and Corridor-wide access to public safety information including emergency telephone, police, repair shops, and medical facility locations.

The following secondary goals may also be addressed by a given technology;

+ Increase availability of traveler information by providing timely, accurate, and Corridor-wide access to traveler information services, including regional weather and environmental conditions, and lodging, restaurants, parking, and gas station locations and hours of operation.

+ Increase tourism by providing access to information on historic sites, attractions, parks and recreational facilities, cultural and arts activities, and educational institutions.

+ Contribute to an organized revenue-generating scheme to supplement Corridor TIS funding, such as privatizing parts of the TIS system, advertising, equipment rentals (e.g., in commercial vehicles), and ticket sales.

The issue of cost effectiveness of the technologies is addressed in Section 2.4.

This section addresses neither VMS nor HAR, because they are covered by I-95 Corridor Coalition Project 9.

2.3.1 Faxes

These were reported as being in use by eight of the responding agencies.

This technology encompasses two classes of service that may be provided:

- Standard use of fax machines as a way of disseminating information, where the fax machine is used to either facilitate the sending of the information to multiple destinations with little effort, or to enable the dissemination of information at a more detailed level than could be transmitted by voice alone.

- Use of autofax technology where a computer system, on which all traffic-related information is entered and stored, automatically generates and sends fax messages to either a list of predetermined interested parties or on demand.

The vast majority of current applications of fax technology fall under the first category; the second requires a higher level of equipment investment than the first. However, note that the second application is not an automated gathering of information (with its associated high costs), it is merely an automated dissemination technique.

The survey respondents reported medium to high satisfaction with systems using fax technology. However, as these systems also included other technologies, it is unclear which of the technologies generated this level of satisfaction. In general, users of fax technology nationwide have indicated that it serves as a good medium for the dissemination of traffic information, especially information about scheduled events, such as construction or special events.

The contribution of fax technology to achieving the high and medium priority goals is to provide information to primary information disseminators, such as media outlets.

2.3.2 Pagers

Two agencies reported using road and traffic pagers for information dissemination. The respondents reported medium to high satisfaction with pagers. The disseminated information in both cases does not include any multimodal information.

The benefits of using pagers to disseminate traffic information are as follows:

+ The units are fully mobile.
+ The infrastructure to transmit the information already exists.
+ The units are relatively low-cost, especially if they are multiuse pagers.

However, this technology also has some drawbacks:

+ The information that can be disseminated is very limited -- it must typically fii within three lines of text (240 characters), with no graphics capability. Experience has shown that in practice most traffic and traveler messages can fit within two lines of text. For larger size messages, a simple solution exist -- two messages are sent.
+ The units can be expensive if the end-user has no other use for the pager unit. The market, therefore, is normally with salesman, doctors, field service engineers, couriers, etc.

Pagers would certainly be of benefit for use within an agency to disseminate information to maintenance personnel, managers, and other interested parties. However, the limited size and scope of messages that can be displayed on current pager technology limit their attractiveness for use as dissemination devices for the general public. In some situations, they may be attractive for commercial fleets, as a means of keeping their drivers informed of traffic congestion and other related information.

2.3.3 Kiosks

The use of kiosks was reported by seven of the member agencies. Satisfaction level was rated as being high. The main benefit of these information kiosks is that they can provide information on any mode of transportation, in addition to other transportation-related information, such as hotel availability. Typically, these units are most effective at major intermodal transfer points or public areas, such as airports, train stations, and service plazas. The main drawback of kiosks is their inability to reach motorists en route. They are, however, suitable for such services as multimodal pretrip planning and general traveler information services.

Detailed information on public kiosks was obtained from PANYNJ and Maryland Transportation Authority (MDTA) as follows.

2.3.3.1 PANYNJ Kiosks

PANYNJ operates kiosks in their three major airports (JFK, LaGuardia, and Newark) to improve customer service during peak travel times, and when there are long waits for information. Two kinds of kiosks are used. The first is more of a TV broadcast providing welcoming messages and daily updates of news, weather, sports, and information in recent magazines. The information is displayed on 32-inch monitors throughout the airports. The second kind is an ATM-style interactive kiosk. These kiosks are at waist-level and are touch screen color terminals that provide the following three types of information:

+ Airport and Airline Information - airport maps showing locations of various terminals, airlines, shops and services (e.g., general airport information, food, police, emergency, medical). Real-time arrival/departure or airline schedule information is not provided through these kiosks.

+ Ground Transportation - including public mass transit (e.g., Express Bus) or shared-ride (vans, busses) information, available by area, city, or destination (e.g., how to reach a given hotel).

+ Tourism - information regarding restaurants, hotels, and entertainment.

The kiosks are installed and maintained for free by MetroVision in areas such as baggage, food courts, and gate areas where passengers spend up to 20-30 minutes waiting. LaGuardia has eight of the large broadcast TV kiosks and seven interactive kiosks. JFK has 10 large broadcast TV kiosks and one interactive kiosk. Newark apparently only has one interactive kiosks. The contract calls for at least eight interactive kiosks, 20 broadcast TV monitors, and one video wall per airport. Companies pay fees to have their services advertised. According to PANYNJ, no recent user feedback is readily available, although the kiosks are installed and heavily used in major traffic areas. Over 1800 people used one of the kiosks during the one-week period from 11/2/94 to 11/9/94 (1 week), according to PANYNJ. That amounts to over 268 sessions per day or 11 sessions per hour.

2.3.3.2 MDTA Kiosks

The MDTA kiosk is located at Maryland House. Maryland House is a tourist information center on I-95, north of 695 in Baltimore, near Aberdeen. The main kiosk is upstairs. Actually, the kiosk is more of an electronic travel board which has the following features:

+ Regional map of the entire I-95 Corridor to Florida.

+ Video touch screen.

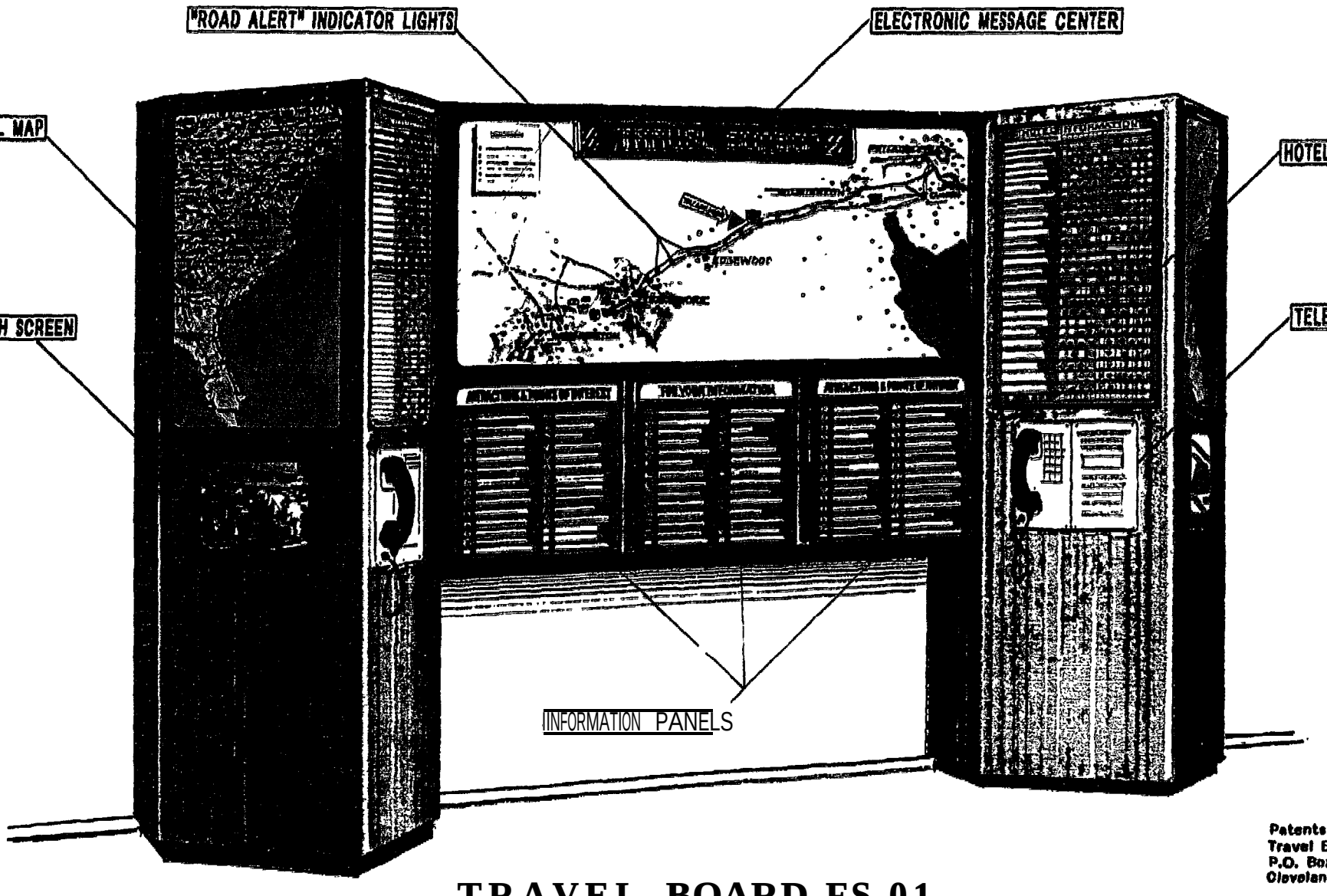
+ Hotel panel with telephone for direct connections to participating agencies.

+ Information panels for attractions and points of interest and other types of services.

+ An electronic message center with “road alert” indicator lights for construction and roadway incidents due to accidents or inclement weather conditions.

For an illustration of this kiosk, see the attached colored graphic. In addition to the MDTA kiosk, the Maryland Tourism office operates a Discover America kiosk a few miles north of Aberdeen, at an I-95 rest stop. This kiosk provides maps of all major U.S. cities, special attractions, restaurants, **hotels,** and entertainment for a given destination. In addition, a telephone is provided and the machine accepts credit cards for ordering services **and making reservations.**

MARYLAND HOUSE



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TRAVEL BOARD FS-01

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Figure 2-3. Sample Kiosk/Travel Board

2.3.4 Cable or Regular TV Using Images

Four agencies reported using this service. Satisfaction level was medium to high. Probably the most interesting case is that of Montgomery County's Traffic Management Center (TMC) which provides a "live" video feed of all 16 Closed-Circuit Television (CCTV) cameras to a dedicated cable TV channel. This channel provides pretrip travel information via a video tour of all CCTV cameras with superimposed camera locations during peak times. Video imagery in-home TV screens is then supplemented with audio text describing traffic incidents and congestion. The audio information is kept up to date and is also provided via HAR.

This technology is most suited for use in an urban area where CCTV cameras can be used to capture images of the state of critical roadways. The images can then be provided to commercial TV stations for broadcast on traffic news reports.

This technology has limited influence on mode shift from highway to transit. It may influence a traveler to choose public transportation if the roads appear congested; however, it can provide no details regarding conditions of public transportation services. Another problem is that this technology only provides travelers with qualitative information regarding the roadway performance -- it may be difficult to infer travel times and delay from video images of peak period traffic, especially for the untrained motorist.

2.3.5 Cable or Reaular TV Usina Teletext

The use of this technology was reported only by the Montgomery County TMC (previously described). Satisfaction was high.

This service can be provided (through TV media) to travelers pretrip or, through monitors located at major intermodal transfer points, to travelers en route. One of the benefits of this service is that it allows for the dissemination of quantitative information regarding travel conditions across modes, which CCTV image transmission does not. However, this does mean that the system

must be capable of determining these traffic features. This technology is more valuable when combined with other forms of complementing technology (e.g., audio, graphics, imagery, etc.)

2.3.6 Interfaces to Radio Stations

Seven agencies report using this service with medium to high satisfaction.

The obvious advantage of this means of information dissemination is the ability to reach a very wide audience, both pretrip and en route. The mechanism to send information to radio stations is normally facsimile.

One segment of the population that may not be reachable using this service is en route public transportation users. Sometimes these users may have personal radios but, in most cases, they do not.

2.3.7 Telephone Access Usina Phone Menus/Recordinas/Attendants

Nineteen agencies reported that they employ this service (overall the most supported TIS technology in place), with medium to high satisfaction levels. Some of these 19 agencies provide only human attendants to provide traveler information; others provide either recordings or user-specific information via phone menus (e.g., press 1 for transit, 2 for highways, etc.). Some agencies, however, reported that the system becomes overloaded during peak travel times (e.g., tourist season and poor weather conditions).

This service is useful to pretrip travelers who, by using the telephone menus, may judge the current conditions of the roadways and the other transportation modes. The service is flexible in that it allows for the provision of different levels of detail, and geographical and modal separation, under the menu structure. This service is also flexible in that cellular telephone users may access this information en route. A major drawback is the problem of raising travelers awareness of the service to the level where they will use it frequently. For a service that is provided in conjunction

with other activities, such as on TV or on roadway-based signing, the traveler does not have to make a conscious decision to initiate the service: whereas for this type of service, the user's actions are required.

2.3.0 Online Information

This section is separated into two subsections: Dial-In services and Internet accessed information.

2.3.8.1 Internet-Accessed Information

This service was reported to be used by one agency and planned to be used by two other agencies. Satisfaction levels were unreported. The one agency that currently provides Internet accessed information is the SEPTA. Information is available via "telnet" to a University of Pennsylvania Internet server, as this service was originally setup to provide rail schedule, fare, and route data to university students. Telnet is basically a service that allows other Internet nodes across the region to connect to the server to obtain information. Information from SEPTA is available at the following Internet node: penninfo.upenn.edu.

In addition to telnet service, many other Internet capabilities exist. The most prevalent to date is Mosaic. Mosaic is a graphical client that obtains voice, image, and data from any Internet server. The Montgomery County TMC in Maryland has plans to setup a Mosaic server to provide information to area travelers. The Mosaic server will provide real-time, link-oriented information. In fact, a "live" copy of the real-time, color-coded map that is used in the TMC will be available through Mosaic. Many other areas of the country have already deployed such systems (e.g., San Diego, Orange County, Los Angeles, San Francisco).

This service is very limited in that it only reaches a very small section of the population. Only travelers with Internet access at the workplace or dial-in access via a service provider from home are able to use the service. As a result, it would probably only be suitable for use as a secondary means of providing information on the transportation system. On the other hand, Internet access is expanding rapidly...the amount of world-wide Internet users is estimated to be around 20

million. Moreover, many Corridor high-technology companies, government agencies, and research and educational institutions already have access to the Internet and many more are obtaining access each day. From this perspective, this technology is likely to become one of the major sources of information at the work place. In addition, access to Internet by service providers and user-friendly clients are allowing Internet usage to expand at alarming rates. Figures 2-3, 2-4, and 2-5 substantiate this point. Easy to use tools like Mosaic are likely to become the standard mechanism to access the information superhighway.

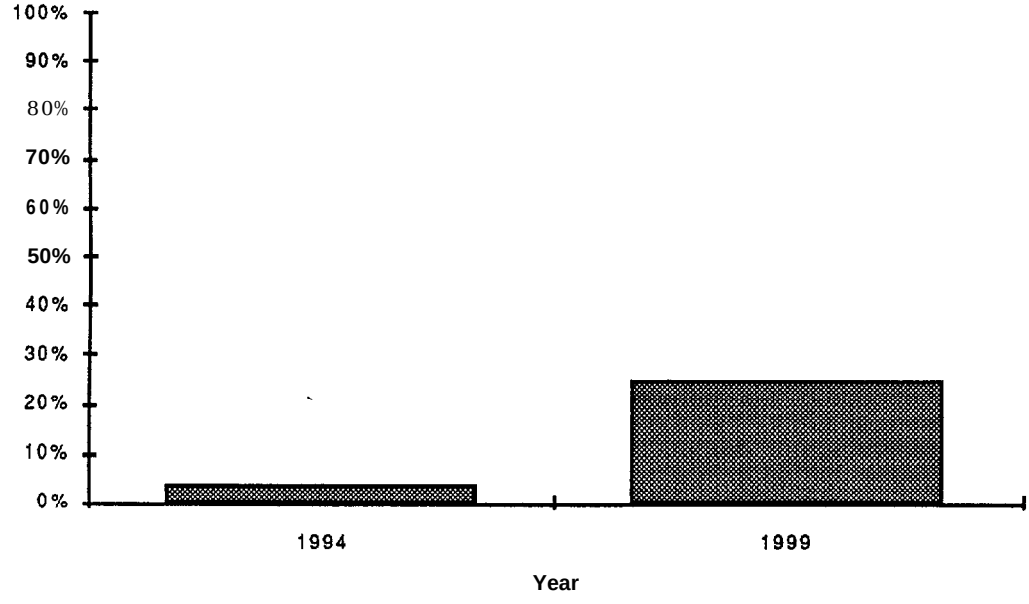


Figure 2-3. Actual and Projected Percentages of Households Online with Service Providers Source: The Arlen Communications

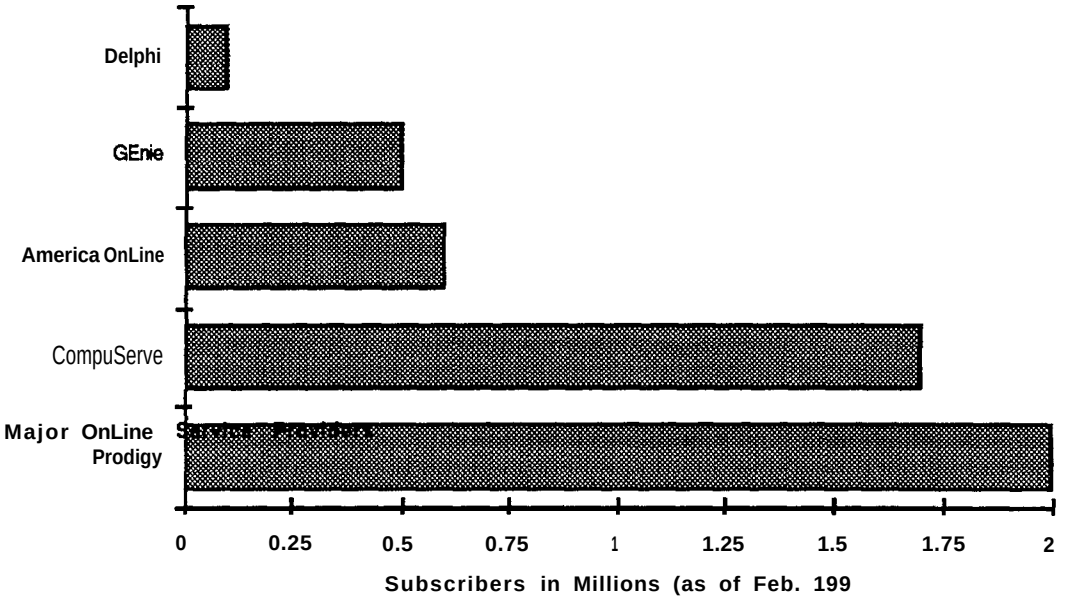


Figure 2-4. Number of Subscribers with Online Service Providers
Source: The Chicago Corporation

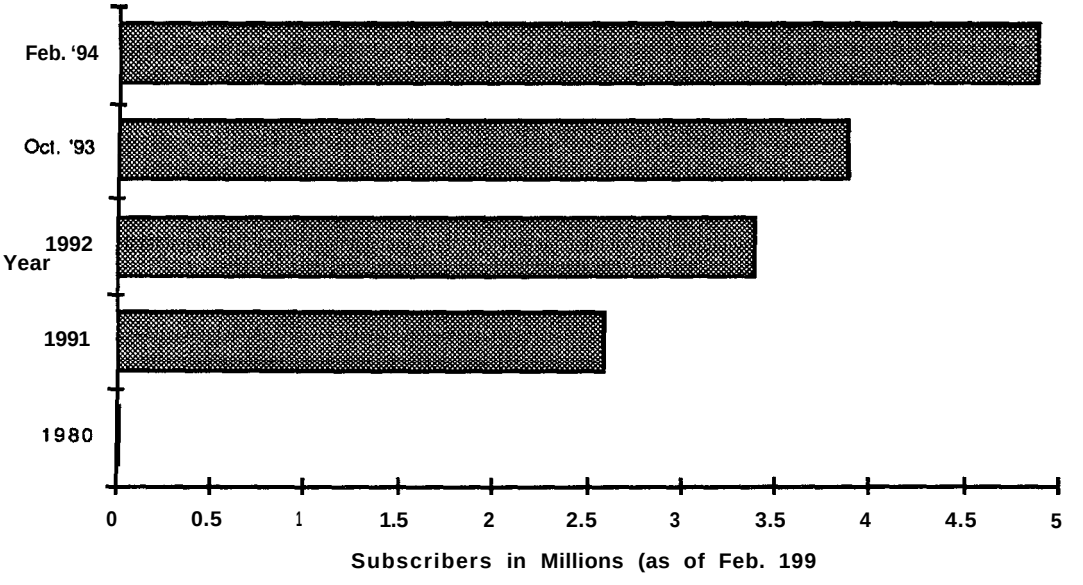


Figure 2-5. Total Online Users with All Major Service ***Providers***
Source: The Chicago Corporation

2.3.8.2 Access to Information via Online Service Providers or Dial-in Commuter Bulletin Boards

This service was reported to be used by two agencies. Three additional agencies plan to deploy this service. The two existing deployments are documented in the following paragraphs.

2.3.8.2.1 New York State (NYS) DOT

The NYS DOT, as part of the information for Motorists (INFORM) program, offers an ATIS graphical software package. The Visual Traffic Information Project (VTIP) is a natural by-product of the INFORM project. VTIP is a piece of ATIS software that displays graphical information to a color computer monitor or in text form to cable TV, regular TV, or radio. The VTIP software is designed to obtain the speed information from INFORM; display the current speed information with color-code links; and automatically transfer information through modems. The software runs on an International Business Machines (IBM) Personal Computer (PC), with a color graphics monitor. VTIP provides several screens including: color map, text screen, travel times screen, delays screen, and travel summaries. VTIP can function in call-in or call-out modes. In the call-in mode, the user's computer calls the VTIP computer for current information. In call-out mode, the VTIP computer calls the user's computer and gives it the information. The VTIP software sells for about $200 and is used by about 40 customers. Most of the customers are information broadcasters (TV and radio stations), although some are public agencies who have the information displayed in the lobbies of their buildings. In some cases, direct, dedicated lines have been provided to customers (e.g., Cable TV, NY City DOT).

2.3.8.2.2 Virainia and Massachusetts "Forums"

Available to all America Online users is information from the commonwealths of Virginia and Massachusetts. Information from other popular tourist states are also available (e.g., Florida). Traveler information, apparently sponsored by the Governor's office and the State Department of Tourism, is provided. Information is provided, as shown in Figures 2-6 and 2-7, in various areas: travel and tourism, transportation, government, etc. Most of the information is static, though some files are available for downloading. For example, under the Virginia Forum, users may download Graphical Interchange Format (GIF) files for Virginia maps. GIF files with current construction locations are also available.

This service is currently limited to a very small fraction of the population that has access to America Online. The number of new users is exploding, however, as awareness increases, For instance, Figure 2-4 indicates America Online (AOL) had around 600 thousand users as of February of this year. That number has doubled over 10 months to 1.2 million users. AOL expects the 1.2 million mark to triple in the coming year. Other providers are anticipating similar expansions.

Figure 2-6. AOL Virginia Forum Introductory Screen

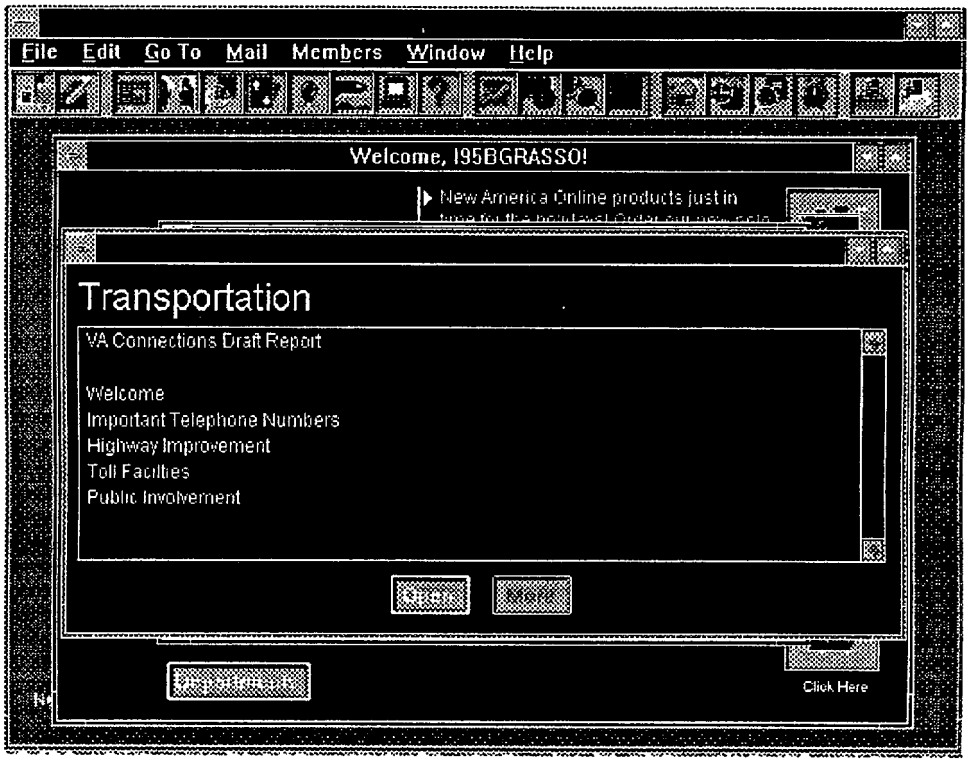


Figure 2- 7. AOL Virginia Forum Transportation Screen

2.3.9 Commercial Traffic Reporting Agencies

Five agencies reported using commercial traffic repotting services with medium to high satisfaction. As reported earlier, the role of commercial traffic reporting agencies may have been underreported, as we know that these services are provided in every major city in the Corridor.

The main benefit of commercial traffic reporting agencies is that they bring experience with a variety of dissemination media and methods to the Corridor ITS. Overall, there is a significant degree of overlap between this and the other dissemination services, because the commercial agencies will act as a third-party, operating many of the services discussed here. The main disadvantage with commercial traffic reporting firms is that information is not available on demand, or in a user-specific fashion.

2.4 ASSESSMENT OF SERVICES' COST-EFFECTIVENESS

The respondents provided little detail that can be used in determining the cost effectiveness of each particular service. They did, however, provide some indication of the relative cost (from a subjective viewpoint} of each of the systems. Unfortunately, each system may include several services.

Based on a preliminary assessment of the costs of the services, the following points may be made:

- There must be a differentiation between total system cost and cost to the member agency. For example, with respect to broadcasting CCTV images on TV, the TV station may be prepared to meet most or all of the cost of providing the service, thereby resulting in a very low cost for the agency of an otherwise high-cost service. The total system cost (the cost to an agency and partners) should be of concern, not just the potential cost to the public agency.
- Fax service is reported to have a low to medium cost, with medium to high effectiveness, making it an attractive option.
- Pager service has a low to medium cost (depending on its use), again with medium to high effectiveness, making it acceptable within the limitation outlined earlier.
- Kiosks were reported as being low cost, with high effectiveness, resulting in a very good cost-effectiveness. In fact, in many locations, the service is free to public agencies.
- CCTV image transmission was reported as being from low to medium cost (it is unclear if this relates only to the agencies' costs), with medium to high satisfaction, making them an attractive option.
- Neither effectiveness nor cost information was provided for teletext information.
- Interfaces to public radio stations had a low to medium cost, with medium to high satisfaction, resulting in a cost-effective alternative.
- Telephone access using menus had low to medium cost, with medium to high satisfaction, again resulting in cost-effectiveness.

+ Neither effectiveness nor cost information was provided for Internet or dial-in accessed information.

+ Commercial reporting agencies were of low cost (presumably to the public agency), with medium to high effectiveness, making them cost-effective from the public agency's viewpoint.

More detailed analyses of the cost effectiveness of the technologies will be performed in later tasks.

3. NEEDS ASSESSMENT

This section assesses the needs met or to be met by traveler information services in the Corridor. The needs of two "constituencies" are assessed:

+ Users (individual travelers and commercial users).

+ Potential business partners.

The needs of public agencies, including operators of transportation facilities, are addressed in this project's Working Paper Z-Definition of TIS Goals.

3.1 USERS' NEEDS

This section assesses the needs of individual travelers and commercial users.

For our later work on defining the requirements for a Corridor traveler information service, we will use user needs identified by Project 6-User Needs and Marketability. However, Project 6 has yet to conduct its survey, so for the purposes of this paper, we have inferred user needs from services.

That is, we have assumed that if some entity-private company or public agency-has devoted resources to providing a service, that service may be meeting a need.

We recognize that this is a dangerous assumption. For many of the services described in Section 2, there is no independent check on whether the service meets a "genuine" need. Without the extensive survey work to be done by Project 6, we had no direct way to verify whether a given service is needed or not. We do believe, however, that we have an indirect way: whether the service has a demonstrated economic value to its recipients.

That is, if the user pays for a service, either directly-out of their pocket--or indirectly-by listening to advertising-we may say that the need for that service is validated. If people pay for something, they must value it, truly need it. Consequently, for example, we view the content of commercial radio traffic reports to be highly validated because commercial radio stations, acting out of their perceived self-interest, pay for this information on their listeners' behalf.

The rest of this section discusses the needs we believe are met by the services identified in Section 2.2. For each service, we discuss:

+ Whether the need the service meets is validated, and how it is validated.
+ The class of user who has the need met by this service.
+ A brief strategic assessment of the need in terms of market development and technology.

3.1.1 Real-Time Incident and Congestion Summaries

This service is the most "valid," with respect to inferred user needs, as it is the staple content of all commercial traffic services. It serves chiefly commuters and intrautban commuters, that is, travelers that know the road network and want to know what's "different" during their drive. This service enjoys a high demand and is the easiest to disseminate, but depends on processing by a human mind. Technology has not progressed to identifying and describing incidents and passing this on to travelers without the intervention of an experienced operator.

3.1.2 Construction Summaries

Because there is no demonstrable evidence that travelers will pay for this information, this service is not well validated. Although it is provided by almost every highway agency, it is provided free of charge, and usually by a low-volume, high-cost medium, i.e., a human operator responding to telephone calls. It serves chiefly commuters and intraurban commuters, that is, travelers that know the road network and want to know what's "different" during their drive. The information that

informs this service is critical operating information for a highway agency, and it is therefore easy and inexpensive for the agency to offer it as a service. Demand is unclear, but appears to be low. It is also technically easy to disseminate, and can be somewhat automated. Having said that, an agency's construction summaries are critical information for agencies operating adjacent transportation facilities; it is this need that led to the formation of TRANSCOM.

3.1.3 Real-Time Link Status

The need for this service is not well validated, having so far faced difficulties in its delivery. If it could be delivered in a readily usable form, the service could be used by all travelers, chiefly in their route decision. Having said that, television stations-the consumer medium that deals in visuals-often display the status of the roadway network in graphical terms suited to real-time link status data.

3.1.4 Parking Locations and Availability

These services are not well validated, likely because of difficulty in delivering it in a readily usable form to motorists. The services should be most useful both to daily commuters, and to casual or business travelers to a "strange" location. If the delivery difficulties can be overcome, we expect these services to meet a genuine need.

3.1.5 Road Weather Condition

There is little evidence of the public's willingness to pay for this service and it is not well validated, but is offered by most public agencies, likely because it is important operating information to each agency. The need this service meets is likeliest held by interurban travelers; we assume that intraurban travelers can not only "look out the window" for road weather conditions, the information is not "actionable" to them, that is, they don't make decisions or take actions based on the road being, for example, icy. Except for severe conditions (e.g., closures), demand for this service is unclear.

3.1.6 Travel Advisories

This service is moderately well validated; not only is it offered by most highway agencies, but travel advisories, when they are issued, are incorporated into commercial traffic reports. Most travel advisories affect interurban travelers the most. Delivery is not especially difficult as they can be viewed as a special kind of "incident".

3.1.7 Alternate Routes

This service is highly validated; most commercial traffic reports advise alternate mutes to get around incidents and congestion. This service is needed by all user classes. It is easy to disseminate, and determination of alternate routes is straightfoward technically but could run afoul of jurisdictional difficulties.

3.1.8 Trip Plans

This service is moderately well validated, as it is a popular service provided by the AAA. However, most interurban travelers-the natural market for this service-do not avail themselves of this service. Prettip planning does seem promising, if it could be made easy, and if en route information updates could be incorporated to optimize the route.

3.1.9 Bus, Train, Subway, Ship, and Air Data (Static or Dynamic)

This service is highly validated, as demand for the information generates thousands of calls daily to transit information lines, airline reservation desks, etc. However, the information is only sought when the traveler has chosen his mode. The traveler class served varies by mode: commuters and other intraurban personal travelers are served by transit data; interurban travelers by air data. The information can be difficult to deliver; post-number-based telephone information lines have proven moderately successful to delivering static or dynamic bus arrival times to a particular stop: but human operators are a must for origin-destination routing and questions about service. It also isn't clear if consumers would pay to find out a bus or airline schedule rather than waiting for

consumers to "pull" the information: providers may have to "push" it through the newly developing information services to the consumer.

3.1.10 Paratransit Services and Ride-Matching

These services are not well validated, perhaps in part because paratransit and ride-matching, while not new ideas or very high technology, are 'new" ideas and the concept hasn't been taken up by consumers. If consumers want paratransit and ride-sharing, we can expect to see demand for these services to rise. These services mostly serve intraurban travelers, both casual travelers and commuters.

3.1.11 Lodging Information: Food, Dining. and Gas

These services are well validated by the success of the AAA's lodging guides and many restaurant guides, etc.. It serves interurban travelers chiefly, and could easily serve as a revenue source for the operating agency, much as the Maryland Transportation Authority's kiosk at Maryland House.

3.1.12 Special Events

This service can be viewed (from a market point of view) as a kind of prearranged incident information; if a special event will affect traffic, travelers want to know about it.

3. 1.13 Regional Weather Conditions

This service is extremely well validated, but the need it meets may be considered already fulfilled. It serves all travelers, but particularly interurban travelers. Weather information may be added to the traveler information stream to give it greater value to the recipient.

3.1.14 Safety Information

This service, despite its obvious appeal, is not well validated; only one agency in the Corridor provides it (as a traveler information service). Although it appeals to all travelers, most may think that "911" is enough. Agencies may have to "push" these data out to travelers, rather than wait for them to pull it.

3.1.15 Regional Environmental Conditions

This service is not validated. It is not clear if any class of traveler feels they need it, nor what action they would take if they had it.

3.2 POTENTIAL BUSINESS PARTNERS' INTERESTS AND NEEDS

This section assesses the needs and interests of potential business partners.

3.2.1 Overview and Methodoloav

Private sector companies with actual or potential interest in providing products or services for a Traveler Information Service within the I-95 Corridor are a key resource for determining what is and may be available from the private sector to initiate, supplement, or complement such services. To better understand the types of companies that may be involved with the development, implementation, use, and deployment of these services, our team surveyed a number of companies and associations that are representative of this type.

In total, 43 questionnaires were delivered via Federal Express to senior executives of several different types of companies with a perceived interest in Traveler Information Services. The range of company type included commercial traffic reporting companies, in-vehicle device

manufacturing companies, navigation software companies, commercial transportation providers, and a variety of electronic communications companies.

Table 3-1 lists the companies surveyed by business sector category as we defined them, and an indication of which responded to either a telephone interview or by filling out and returning the questionnaire.

Table 3-1. Companies Surveyed

Category	Responded	Did Not Respond
Electronic communication companies	Cellular One Continental Cable Geotek Communications MFS Communications Southern New England Telephone Time Warner Cable	**AT&T** Cablevision Systems GTE NYNEX Sprint Telecommunications Inc.
Information service providers	Traff ax Metro Shadow Wayfinder AAA Discover America	None
Hardware and software providers	Personal Travel Technologies IBM Trimble Navigation Sumitomo Electric Nippondenso **ETAK** Navigational Technologies	GM Motorola Siemens Zexel
Commercial transportation providers	National Private Truck Council UPS	Greyhound Trailways US Air Delta Conrail Federal Express

Each of the four business sectors identified in Table 3-1 was analyzed in four particular areas of interest:

+ Current role in TIS industry.

+ Future plans for TIS services.

+ Interest in partnering with the public sector.

+ Business strategy for Traveler Information Services.

The following is a sector-by-sector assessment of each area of interest.

3.2.2 Electronic Communication Companies

3.2.2.1 Current Situation

Most of these companies have very limited direct awareness of TIS per se and certainly no specific focus at all on enhancing travel along the I-95 Corridor. However, many of them are at least tangentially involved in such services as part of their own customer services assistance, or as a tangent to their direct product line (such as Geotek's direct business strategy of delivering voice, data, and text to commercial vehicle operators). There was a fairly remarkable willingness to consider being involved in general efforts of the Corridor Coalition, and to focusing more on TIS products and services. There seems to be a general sense that there is a market in TIS products and services, but very little clear sense of how to approach it.

3.2.2.2 Future Plans

Most of these companies have very aggressive product and service roll-out strategies, whether it includes rolling out more bandwidth (such as MFS, Geotek, and Video Dialtone with Time Warner) or direct information services such as on SNET and NECN. All of them are looking for programming content to enhance their own particular niche in the market and are receptive to ideas for growth and diversification.

3.2.2.3 Interests in Partnering with the Public Sector

Considering many private companies' negative predisposition about the public sector, these companies showed a markedly favorable disposition towards partnering with the public sector. There does seem to be a general awareness that telecommunications, transportation, and air-quality products and services are inherently tied up with the public sector. With the exception of the interest of companies like MFS in partnering on the use of highway rights of way, the general sense is that the private companies need a great deal of help in being given ideas for partnering, but they would look on such ideas generally favorably. What partnering has taken place to date has been reasonably successful.

3.2.2.4 Business Strategies

Very few of these companies have business strategies in place that address Traveler Information Services specifically, although most (such as Time Warner, New England Cable News, Cellular One, and Southern New England Tel already have existing subscriber bases) generally believe that these kinds of products and services would enhance their consumer relations; however, there is some reservation about whether such services can produce revenue.

3.2.2.5 Conclusion

Although most of the electronic communications companies (wireless, telephone, or cable) that we surveyed were not directly involved in the TIS business, they all showed a surprising sensitivity to the value and importance of Traveler Information Services, and a substantial willingness to be involved in their design and delivery. It's clear from talking to these companies that for the I-95 Corridor Coalition to involve them, the Coalition will need to pull together a specific plan or series of plans to which these companies can respond. Most of them are in highly competitive situations, needing to improve their customer relations, enhance the value of their products, and rapidly expand their geographic or product line presence. They will not only need a compelling financial reason to partner, but the financial reasons may have to do with soft issues like product positioning and customer relations and service, rather than direct profit and loss benefits thus suggesting a more plausible market opportunity to the Corridor Coalition.

3.2.3 Information Service Providers

3.2.3.1 Current Situation

Naturally, the information providers were very familiar with the many variations of TIS. Unlike many of the other companies surveyed, this group engages in TIS as either its primary business activity, or as a major company service. Thus, the development of markets, technologies, and financial opportunities is keenly interesting to them. Their interest in the activities of the I-95 Corridor Coalition was great, as was their willingness to participate in TIS along the Corridor.

The general consensus was that the most effective current means of traffic information dissemination is via established media outlets, particularly TV and radio. Electronic media were considered the most effective dissemination method for traffic information because they are "proactive" and don't require the user to initiate an action such as a telephone call. One respondent made an interesting distinction between morning and evening information delivery saying that TV was powerful in the morning, as people have it on in their homes. Evenings, however, are more unpredictable, since most people do not have access to television in their offices.

Although requiring initiative, in-vehicle cellular telephones are being successfully used as a dissemination medium. They are found to be a satisfactory technology, and to have the advantage of being interactive; that is the caller can choose the specific information desired. However, cell phones are still considered to be a limited market (10% of all automobiles by one respondent's estimate, and up to 20% in some major metropolitan areas).

Opinion was mixed on variable message signs. Some respondents found them very useful, while others felt that the information came too late to change behavior, or worse was inaccurate and out of date. Citizens Band (CB) radio was considered old technology for the information providers' purposes.

Information kiosks along highways and in other public or tourist locations are an emerging technology. Discover America is working on a national network of interactive kiosks for tourism

information, and other information providers are developing similar systems for routing and construction and traffic information. Often these development projects are jointly undertaken by information providers, equipment manufacturers, and electronic communication companies.

Similarly, highway advisory radio and dedicated TV, at least during "drive time" portions of the day, were under consideration and partial development. In-vehicle navigation systems and Global Positioning Systems (GPS) were under serious consideration, but thought to be too expensive for a reasonably sized market or return on investment at present.

Information providers gather their data in a variety of ways. Traffic information is gathered from aircraft, through on-site cameras, and via in-vehicle cell phones in both formal and informal networks. In some cases, free cell phone calls are offered to individuals reporting traffic incidents or acting as mobile probes. Informal CB radio reports are also used. The public sector was frequently mentioned as a source of information, occasionally through the use of in-roadway sensing devices, but more commonly from police, highway, transit, and public-safety agencies. Information is passed from the public agencies to the private companies by means of fax, phone, radio, and the private firms' use of scanners.

Respondents had differing views of the efficacy of these traffic surveillance methods. Some felt, for example, that aircraft were the best source of up-to-date information, while another believed that aircraft were too expensive for the quality of data relayed. The latter view is that aircraft, like on-the-ground devices, had to be in the right place to be effective, and they are inhibited by bad weather. Similarly, in-ground sensors were reported to be subject to freezing, and cameras to fogging. One respondent emphasized that it was necessary to have multiple sources for information within the bounds of a reasonable return on investment.

Financially, the information providers differ in the method of charging for their product. The four traffic reporting companies all use some form of the barter system, where the TV and radio stations using their information pay for it with ad space. The information providers then use this space either to resell, to advertise their own service, or both. Some of the traffic information providers and routing services have subscribers, either individuals or commercial fleet accounts. Information delivered over cell phones is usually charged by the minute of air time by the cellular carrier.

The traffic reporting companies reported satisfactory profitability, aithough the cable TV network did not describe the traffic information as a profit center. The other companies seemed to be more in the developmental stages. AAA reported that there was a high user acceptance rate of people using the AAA's experimental trip-planning kiosks, but at the same time there was considerable reluctance on the part of consumers to pay for such a service.

3.2.3.2 Future Plans

Most of these companies had plans for expansion in the future. Their ideas included geographic expansion, more media outlets, newer technologies, and very often joint-venturing with other companies in the field. Many respondents mentioned the need for teaming in order to provide the combination of technical skills, market penetration, and working capital. The higher the technology, the more frequent was this response. So, for example, everyone working on in-vehicle navigation systems, large networked kiosks, GPS systems, dedicated radio or TV, or highly automated dial-in directional services, is working with at least one other entity.

Several respondents considered the key to future market penetration to be the ability to tailor information to specific users. A highly personalized, current, accurate, proactive, and user-friendly system which does not require people to listen to or watch extraneous information was considered to be the primary goal. For information providers who operate in large geographical areas, the key question is how to provide that specialized, current, and accurate information regionally rather for the entire area served. One respondent distinguished between two types of users: those who operate on impulse, who he believes to be the majority, and those who plan their trips in advance, who he believes to be the minority. Clearly different traffic information and routing services will apply to these two market segments.

AAA has a unique perspective on future markets. They described their membership as increasingly elderly, so their future product development is targeted at services for the older segment of the population. Thus, there was an emphasis on products to enhance safety, ease routing and construction information, and eventually information about other modes of transportation beyond the automobile, as people become unable to drive themselves.

3.2.3.3 Interest in Partnering with the Public Sector

The information providers were uniformly interested, even enthusiastic, about partnering with the public sector. This reaction stems from several reasons. Many already work with the public sector to gather information, on special experimental or developmental projects, and sometimes on publicly funded programs. Generally, they were very positive about their experiences, saying that the public sector was essential for access to most of the data which make their services possible. And the public sector was generally understood as the necessary glue to make any Corridor-wide TIS system possible.

When asked about the negatives related to working with the public sector, difficulty in contracting was mentioned. When asked to rank a list of factors which might improve public/private partnership possibilities, four out of the seven named streamlining decision making as the number-one issue; two chose a technical issue as the most important; one ranked better return on investment jointly with streamlining decision making, and one chose not to rank the factors. One respondent suggested that decision making could be hastened if a public/private Board of Directors with equal input was created for the I-95 Conidor project. This, he felt, would provide an idea exchange and mutual understanding of each sector's issues.

The highest-ranked technical issue was the need for one dedicated, interactive computer system along the I-95 Corridor that provides a continuous flow of traffic information. One respondent mentioned speedier decision making in the public sector as the second most important factor. The second technical issue raised was the ability to visualize timely, accurate traffic information. Microwave systems or a fiber -optic network with a dedicated video hookup for cable TV were mentioned as possible means to achieve this goal. Better technical compatibility among systems was also ranked as number two by one of the traffic information providers.

The remainder of the responses were scattered and included: a clearer role for each of the public and private partners, and a clearer definition of the market. A better return-on-investment was only ranked first in one case, but was generally treated as a given. Respondents did not feel that profit had to be the primary motive where a public benefit was involved, but they did expect to make a reasonable return.

3.2.3.4 **Business Strategy**

The return-on-investment or profit issue was more squarely addressed in the section on business strategy, where all the respondents, but one, answered that they would be interested in developing TIS for profit. That one respondent, AAA, was interested in developing membership, which is a similar goal. All were interested in providing a public service: a few considered TIS as a marketing benefit for other products or services, and no one was interested in developing these services for the primary use of their own employees.

The respondents in this group were unanimously supportive of the efforts of the I-95 Coalition, of standardizing technical specifications along the Corridor, of providing uniform data on traffic, construction, route distances, and of creating a truly user-friendly system which people would want to use again. They were all willing to participate in this effort in some way. Their suggestions for areas where cooperation would be most desirable included:

- Creating standardized shortest- and best-route databases which could be dynamically updated.
- Creating services which are user-friendly.
- Creating a list of every radio station fax number along the Corridor, to which information can be sent.
- Helping to create a “holiday network” for traffic information using the fax list and potentially a satellite receiver network at radio stations along the Corridor (this respondent felt that such a satellite network would need to be underwritten for many of the smaller stations).

All of the respondents were interested in developing TIS for the consumer market: some were also interested in commercial clients, in wholesaling information for resellers, and in selling to advertisers. Many of the respondents in this group, as previously noted, already sell advertising. Some of the respondent companies had engaged in market research either themselves or jointly with other companies. One respondent, Wayfinder, sent along some material. One respondent,

Traffax, relied on Arbitron data to determine the size of the listening audience on different media outlets.

All of the respondents would consider providing information on other travel modes besides the automobile, and three already do. One respondent said his company could easily do it now, but the radio stations were not interested. Discover America has Amtrak on its Board of Directors, and AAA, as mentioned before, is seriously considering providing information on nondriving modes for older members. None of the respondents in this group had a sufficient number of employees to be individually affected by the provisions of the Clean Air Act.

3.2.3.5 Conclusion

The information providers, as a group, offer a considerable resource to the I-95 Corridor Coalition. They are naturally very interested in TIS, its future technological integration and development, and its acceptance by the public as access to information becomes easier to ubiquitous. Most important, they are eager to work together with the public sector and to provide their expertise to the Coalition.

3.2.4 Hardware and Software Providers

3.2.4.1 Current Situation

All seven companies surveyed in this business sector showed a high degree of knowledge of TIS's currently in use, and generally thought that these services were effective. Since these companies are involved with navigation software and in-vehicle device production, it was not surprising that all thought in-vehicle navigational systems were among the most promising services.

The types of services and products currently provided by these companies include digital maps and applications software, navigation software, in-vehicle navigation devices, portable computers, mapping databases, kiosks, tourist "Yellow Pages", automatic vehicle location software, and

transit information systems. Geographically, these companies operate in the United States, Europe, and Japan.

All of the respondents felt that the technology exists today to provide good traveler information services, while splitting on the question of the financial feasibility of TIS. Two respondents reported a satisfactory financial experience, with one of those explaining that their TIS service had just become profitable for the first time. Four others expressed dissatisfaction with their experience financially on TIS, reflecting that they were still in investment mode or that the market was too small at this point to support a financially profitable venture.

None of these firms operate their own surveillance systems. Some do rely on others to provide them traffic information to augment their basic services.

3.2.4.2 Future Plans

All of the companies surveyed in this business sector have plans for expansion. The two Japanese companies, for example, are exploring ways of establishing a market presence in the United States. Both of these companies are manufacturers of in-vehicle devices which have much broader use in Japan than here in the U.S. They are closely watching the development of this industry here to prepare their entry into this market.

Companies in the navigational software business, like ETAK and Personal Travel Technologies, are looking to expand both geographically and technologically; both expressed intentions to include additional services into their products, including dynamic routing information, transit information, ride-sharing, news, weather, tourist services, and so on.

Still other companies, like Navigation Technologies, whose basic business is licensing navigable mapping databases to value-added resellers, is seeking to expand primarily by adding new customers for its existing product. IBM was the only company surveyed that expressed uncertainty about expansion in the TIS marketplace.

In summary, all of these companies are interested in possible expansion in this market, but there is a high degree of uncertainty about exactly how and when this expansion will be possible.

3.2.4.3 Interest in Partnering with the Public Sector

All of the companies expressed an interest in partnering with the public sector. Some of the positive points of involvement with public/private partnerships according to the companies in this business sector include the public agencies' ability to assist with funding for technology development, market research and development, and the testing and evaluation of new products. Some of the negative points mentioned included bureaucratic delays and constraints, lack of coordination among agencies, and loss of control of the process.

The companies, interestingly, were almost unanimous in their view of how best to improve public/private partnership possibilities. Six of the seven companies surveyed chose streamlining decision making as the best choice for improving this process. Other factors chosen by more than one company for improving public/private partnership potential included a clearer definition of the market and better technical compatibility among systems. Still other choices were defining a clear role for each sector and better return on investment.

3.2.4.4 Business Strateay

Not surprisingly, all respondents described their business strategy for developing TIS products as a "for profit" strategy. The second most frequent response to this question was tying the business strategy to "public benefit", possibly reflecting the leading role that government has held to date in the development of TIS in the United States.

All companies have a high degree of interest in the efforts of the I-95 Coalition to further develop TIS in the Corridor. There was also very strong support for the standardization of technical specifications for TIS in the Corridor, and a willingness on the part of most to participate in this effort.

All companies identified the consumer market as one their products were intended to reach, with the exception of Navigation Technologies, whose primary market is value-added resellers making them, in effect, a wholesaler. Three companies identified commercial users as a market for their products, while two identified advertisers.

There is a strong interest among this business sector in providing services to transit agencies and their customers. Several mentioned the possibility of establishing information systems for transit including real-time signage at bus stops and on transit vehicles. Commercial vehicle fleets are seen by some respondents as an early adopter market for TIS services and therefore are part of these companies strategic planning for early TIS sale.

3.2.4.5 Conclusion

All of the companies in this business sector have existing involvement with TIS products, services, or projects, and therefore have a detailed knowledge of the subject matter. While many of the American companies have specific experience with partnering in this country, the Japanese companies surveyed have an interesting set of experiences with their government and in the partnering arena. It would be helpful to further explore the partnering process for TIS in Japan and Europe as part of our later tasks in developing models for public/private partnerships.

3.2.5 Commercial Transportation Providers

3.2.5.1 Current Situation

Given the limited number of responses to the survey received from this business sector, the conclusions drawn with regard to this and later topics are less reliable than the three previously discussed business sectors. Both the airline and intercity bus industries provided no response at all, while the trucking industry provided limited information with which to work.

Types of TIS used by companies in this business most often include en route electronic signage, highway advisory radio, and informal CB radio networks. Comments offered with regard to the first

two services is that they often are of use only after the driver finds him or herself in a congested situation. They rely on CB radio to try to avoid congestion.

3.2.5.2 Future Plans

Both the National Private Truck Council (NPTC) and United Parcel Service (UPS) expressed interest in in-vehicle devices for better delivery of TIS to drivers. UPS is considering cellular communication to better inform their truckers of traffic conditions, while the NPTC discussed the desirability of integrating all in-cab information into one device, which would handle transactions, equipment analysis, routing, safety analysis, and real-time traffic information.

Both respondents also raised the issue of alternate route information being critical for any in-vehicle information systems.

3.2.5.3 Interest in Partnering with the Public Sector

While UPS did not respond to questions with regard to public/private partnerships, the NPTC enthusiastically supported more activity in this area. From their perspective, the opportunity to interact with multiple public jurisdictions that regulate trucking, such as those represented by the Corridor Coalition, is essential to improving their operations.

As far as partnering with the public sector to develop TIS products or services, the NPTC saw little or no prospect of this, as they view themselves as consumers of TIS, and will purchase effective products from whichever sector develops them.

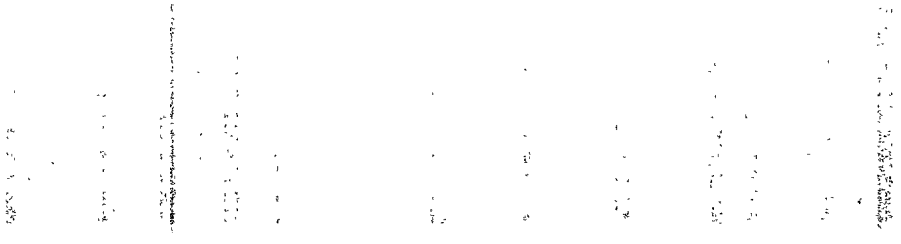
3.2.5.4 Business Strategy

Clearly, neither respondent has a focused business strategy for deploying or utilizing TIS. Although there is a high degree of interest in what products or services may eventually be

available to commercial transportation, they are not taking a leading role in their development at this point.

3.2.5.5 Conclusion

The lack of interest of commercial transportation providers to participate in this survey was disappointing. It does point out, however, that more outreach to this business sector, presumably a heavy user of TIS when deployed, may be called for.



4. CHALLENGES AND ISSUES

This section discusses the challenges and issues facing the development of a Corridor traveler information service.

The l-95 Corridor is a challenging geographical area in which to develop an intelligent transportation system. Not only does it cover 12 states and the District of Columbia, numerous public transportation jurisdictions, 10 large metropolitan areas, and 50 million people, but also few if any, relevant private-sector entities encompass the whole area. There are two major telephone companies, several cellular carriers, hundreds of cable television franchises, dozens of paging services, dozens of regional trucking companies, hundreds of major regional retailers, and countless other satellite and computer communications systems. In a sense, the only uniform physical infrastructure which links the entire area is the highway itself. Thus, the l-95 TIS is an ambitious enterprise for both the public and private sectors and will serve as a unique Corridor-wide communications network. The issues are summarized in Table 4-1.

Table 4-1. issues

Category	**Issue**
Market Development	The readiness of the consumer market to accept specialized traveler information services has not been demonstrated.
Institutional	Multiple, overlapping agencies and invisible jurisdictional hand-offs complicate the processing, dissemination, and especially collection of traffic information.
Institutional	Between the public and private sectors, the exchange of traveler information is almost always the result of informal, undocumented working relations, often if not usually at the lowest management levels of the public agency.
Public policy	How can a public agency both meet its public-policy objectives through broad dissemination of traveler information while making commercial agreements for the resale of traveler information?
Legal	Who owns traveler information?

4.1 CONSUMER ACCEPTANCE AND MARKET DEVELOPMENT POTENTIAL FOR TIS [redacted] ND SERVICES

The readiness of the consumer market to accept specialized traveler information services has not been demonstrated. For an excellent survey of the market for traveler information, see the Volpe Center's study.[2]

The developing supply side for traded traveler information may be divided into three categories along an axis of specialization:

+ At the most specialized are devices or services devoted entirely to traveler, particularly traffic, information.

+ In the middle are services that use preexisting communication devices to deliver traveler or traffic information in new ways.

+ At the least specialized are services that insert traveler information into their information stream.

4.1.1 Highly Specialized Products

Consumer acceptance of single-use devices has been the poorest. Users of TravTek were lukewarm at receiving congestion information. The only known product in North America devoted solely to traffic information, Way to Go, collapsed from near zero sales. Some niche products, for example, one devoted to routing motorhome drivers along the Interstate Highway System, have met some success.

[2] Jane E. Lappin, Suzanne M. Sloan, Robert F. Church. "A Market Analysis of the Traffic Information Business." Cambridge, Mass.: John A. Volpe National Transportation Systems Center, 1994.

4.1.2 Using Preexisting Channels

Better results have been seen in services that piggy-back on communication devices that the user already values. Two in particular stand out: cellular telephones, and pagers. As both this paper and the Volpe Center's study show, there is considerable use of cellular call-in lines, both to give and to receive traffic information. But a key item is that demand for such services is much higher when it is free of air-time charges.

Traffic messages to alphanumeric pagers have met with modest interest in several markets. Because the incremental cost to rolling out such services is low, development continues despite limited acceptance.

4.1.3 "Incidental" Traveler Information

Traveler information is a staple of radio and television's "news and information packages", most notably on news-oriented stations. Most such stations will give more air time to traffic to information during the morning and evening peak hours.

The key characteristics of such highly accepted services are that:

+ They are free to the user, generally paid for by advertisers.

+ They are inserted into a stream of information, using a device (a car radio) that the user views as low tech, the user needs to make no special effort to receive traffic information.

+ They are highly actionable, that is, the user will be able to react to the information.

4.2 INSTITUTIONAL ISSUES

On the public-sector side, the processing, dissemination, and especially the collection of traveler information is vastly complicated by the number of agencies and jurisdictions that are involved with providing the service.

A roadway may be owned by a city, county, or state department of transportation, by a turnpike authority, or by a nontransportation agency.[3] Two roadways that form what the motorist views as a single corridor may be owned by different agencies or may be in different states. Worse, a given roadway may be owned by different agencies at points invisible to the motorist.

The roadway may be patrolled by city or county police, county sheriff, state police, or state or city highway patrol. Fire services may be provided by one of many different departments.

Throughout the I-95 Corridor there are examples of invisible jurisdictional hand-offs and overlapping agencies. Because of the agencies' differing constituencies and funding, there is often little incentive to cooperate-operate or exchange or share information, particularly where these efforts impose costs. That they do so at all is a tribute to their public-spiritedness.

On any given roadway, three distinct agencies may have day-to-day contact with travelers and traffic:

+ The owner and operator of the road (e.g., the state department of transportation).

+ The law-enforcement agency that usually patrols the road.

+ The fire service.

[3] For example, in the Washington, D.C., area, some arterials are owned by the Agricultural Research Service; some major commuter routes are operated by the National Park Service.

Law-enforcement agencies take command of accident scenes, and supervise the cleating of the roadway. But law-enforcement commanders are not usually rewarded by how well their personnel get traffic moving again, or keep the local DOT informed.

Because of the fragmentation of operational responsibilities, short-term interests may conflict. For example, a county DOT may not approve of the state DOT's diverting traffic from a freeway onto local arterials. More significantly from a traveler information point of view, no single entity "owns" what the traveler sees as the single problem of traveling in a locality or along a corridor.

Perhaps the key reason that commercial traffic services thrive is that a third party is best able to integrate traffic information from sources in different states, counties, cities, and public-safety agencies.

Cross-jurisdictional institutions for transportation are possible, for example TRANSCOM; **a more** recent example is the Washington Metropolitan Area Transit Authority, which is accountable to two states and the District of Columbia. However, these examples are not the norm.

Between the public and private sectors, the exchange of traveler information is almost always the result of informal, undocumented working relations, often if not usually at the lowest management levels of the public agency. Commercial traffic services make it a point to cultivate good personal relations with dispatchers, Traffic Operations Center (TOC) operators, etc. In one case, where a commercial traffic agency had successfully developed good relations with both the dispatchers and the commander of a law-enforcement agency, the information flow was high in both quality and quantity. By the same token, cool personal relations between the commercial agency and the local commander or district manager of a public agency seemed to choke off the information flow.

The commercial traffic reporting firms operate, to one degree or another, their own "surveillance" services. Some are establishing their own CCTV networks. In one example of the latter, the commercial firm could not get siting on a public road allowance, despite the proposed siting's transparency to the public agency's operation. Going the other way, public agencies have not taken up commercial firms' offers to share the commercial firms' CCTV images. The reason most cited for not sharing surveillance assets centers around the control of the asset.

The issue is that the public sector, in general, does not take a consistent attitude and approach to their dealings with private-sector entities that fall outside the usual categories of applicant or contractor. Concerns arising from this issue include:

- Informal relations may be seen not to be even-handed.
- Disseminators of traveler information cannot depend on the quality, quantity, or consistency of information from a public agency with which it has informal, personal relations.
- It is not clear who is accountable to whom and for what.

4.3 PUBLIC-POLICY ISSUES

Based on our survey, the key public-policy issue to our public-agency respondents was how to simultaneously meet their public-policy objectives through broad dissemination of traveler information while making commercial agreements for the resale of traveler information. Some possible approaches to resolving this dilemma are discussed in Section 5.

4.4 LEGAL ISSUES

The public-agency respondents to our survey highlighted one legal issue of particular concern: who owns traveler information? At the moment, information developed by public agencies is exchanged, reused, resold, etc., largely as if it were in the public domain. The same is almost as true in the private sector, though we understand that two firms had some legal difficulties over one's allegedly using information the other had developed. If traveler information isn't in the public domain, both public- and private-sector developers of information will have to carefully consider the legal underpinnings of their business, and may have to "contractualize" all exchange and transfer of information.

5. PRELIMINARY PRINCIPLES AND SCENARIOS FOR INTER-SECTOR PARTNERSHIP

This section:

+ Presents the public agencies' and potential business partners' attitudes toward private-sector participation in traveler information services in the Corridor.

+ Develops preliminary "Principles of Partnership" and scenarios for private-sector participation in Corridor TIS.

This forms baseline information for the Principles for Partnership and scenarios to be developed during Task 6.

"Public/Private Partnership" is a phrase which has wide usage in speeches, media reports, and academic papers, but which is not always easily defined, especially vis-a-vis any specific product or service. People generally consider the concept of public/private partnership to be a good thing, but they are less at ease describing how it works, or who is responsible for what. This is not surprising, since such partnerships may take many forms, and they are less frequently encountered than might be expected given how often they are discussed.

Before launching into the findings of the two surveys, it is important to establish some overall principles that underlie the responses of both the public and private entities surveyed. These principles were sometimes clearly stated and sometimes simply assumed, but in either case they represent the foundation on which future partnerships will be built.

+ The purpose for public/private partnerships is to accomplish public objectives:

  · More quickly and efficiently.

  · More cost-effectively.

- To take advantage of the latest technological advances.
- To provide sufficient sources of capital to develop new systems.
- To enhance the overall economic benefits of the area served.

+ Both the public and the private sectors have the potential to gain from collaboration.

+ The fundamental purpose of each sector is different, and these differences must be recognized and respected. The public sector exists to provide a general public good, while the private sector exists to produce a profit.

+ These goals are not mutually exclusive. Defining how they might be congruent is the point of this task.

+ The public sector cannot be seen to subsidize or provide for only one segment of the public. Thus, publicly sponsored TIS projects must include services which are widely available and not limited to users of expensive receivers.

+ The private sector cannot invest in projects without an eventual and adequate return.

+ TIS products developed through public/private partnerships must be multimodal and encouraging of environmentally constructive transportation choices to assure that the ultimate policy goals of improving traffic flow, decreasing congestion, and improving air quality are met.

5.1 PERSPECTIVES ON PUBLIC/PRIVATE PARTNERSHIPS AND PRIVATIZATION

The following discussion will give a synopsis of perspectives on public/private partnerships from the results of two surveys, one conducted for each sector.

5.1.1 Public Sector

Fostering public/private partnerships is intended by the public sector to mitigate the risk and expense of implementing an intelligent transportation system while providing the opportunity to give system users value-added services. Developing long-term partnerships helps to ensure that new technologies are added to the system so that capabilities remain state of the art.

5.1.2 Private Sector

In a remarkably consistent fashion, the results of the private-sector survey support the concept of public/private partnership. In all sectors surveyed, there was enthusiasm about developing traveler information systems jointly with the public sector. Four categories of related businesses were surveyed: hardware and software manufacturers, electronic communications companies, transportation providers, and information providers. As might be expected, the level of interest increased with the company's proximity to the traveler information business. Thus, information providers were most eager with a unanimous interest in partnering, while the transportation providers were the least responsive. The latter's interest was limited to using a finished product if it is available, convenient, and not too costly.

Most of the private companies surveyed accepted, at least tacitly, that transportation infrastructure and services, telecommunications, and air quality were to some degree the purview of the public sector. And they were pleased that such a large group of public agencies were collaborating on a project of the geographic and technical scope of the I-95 Corridor Coalition.

On the other hand, there is some skepticism about the ability of the public sector to achieve the laudable results desired from TIS. The most troubling aspect from a business point of view is the difficulty and length of time it takes for the public sector to make a decision. This is particularly apparent in the area of contracting, where companies with public-sector experience complained about red tape, inordinate time, and multiple jurisdictions often with conflicting views. There is a basic suspicion about whether the public sector can be decisive on a schedule which meets the private sector's financial and operational needs. In addition, there is confusion in the private sector about how this concept of public/private partnership actually translates into the day-to-day

operation of a business, and about what role each sector plays. At the same time, there is a fundamental belief that the two sectors need each other's resources and expertise.

From the perspective of the public sector, there are also difficult issues to consider about their potential private sector partners. A key problem is the number of competing private companies along the Corridor who would find it difficult (if not impossible) to work together with each other to provide or share equipment, data, or other resources. At least one company surveyed refused to respond, because they were hesitant to share any information at all. It is impossible to tell if this was the reason others did not choose to respond. Thus, a key challenge for the public sector in designing and defining these partnerships is to harness the competitive, profit-minded motives of private companies, while maintaining a fair competitive environment for achieving the ultimate public-policy goals.

5.1.3 Definitions of Public/Private Partnerships

5.1.3.1 Public Sector

Public agencies plan on taking advantage of the skills and efficiencies of the private sector. The Rhode Island Department of Transportation noted that flexibility in providing public information was one of the benefits of a partnership with the private sector. Substantial portions of the construction and operation of the TIS infrastructure could become the responsibility of the private sector through the partnership. The Pennsylvania Turnpike Commission indicated that the private sector was in a position to do a better job of reaching out to the public. Public/private partnerships provide a means to ensure delivery of a complete, innovative, and expandable system that would otherwise be unaffordable.

The majority of public agencies expressed a willingness to participate in public/private partnerships although they were aware of the challenges. The Delaware River Port Authority responded that partnerships could cause problems if not properly established. Public agencies indicated that partnerships among multiple agencies and the private sector require balancing the needs of all participants. Identifying the roles of public and private agencies is an important requisite. Public-sector control and ownership of the data, return on investment or revenue sharing, and liability need to be clearly defined so each agency can fulfill its responsibilities within

the partnership while working to its own charter. The partnership definition needs to be developed to support long-term association between all public and private agencies to ensure the success of system development and implementation.

5.1.3.2 Private Sector

Private-sector companies were uncertain about the definition of partnerships with the public sector. Several companies mentioned partnering experience, but in many cases those experiences were traditional public-sector procurement of goods or services rather than partnering in any broad sense. On the other hand, there were several significant examples of partnerships on the private-sector side. Many respondents mentioned the need for teaming in order to provide the combination of technical skills, market penetration, and working capital to develop a new TIS product. The higher the technology, the more frequent was this response. So, for example, companies working on in-vehicle navigation systems, large networked information kiosks, geographic information systems, or highly automated dial-in directional services were working with at least one other entity.

When asked if they had an interest in partnering with the public sector, many positive responses from private companies came with the caveat that they would need to know exactly what that partnership entailed. Cooperation was easily offered, while partnership was a more elusive concept. It may be fair to conclude that initiative for partnering must come from the public sector. A set of definitions about what is intended and how to achieve it is probably not going to emerge from the private side. This is largely a result of factors already mentioned: the private sector's hesitance about public sector decision making and regional coordination.

5.1.4 Expectations for Public/Private Partnerships and Privatization

5.1.4.1 Public Sector

Public agency responses to this question focused primarily on the expectation that issues surrounding data use and management would be clarified by the public/private partnership

framework. The Virginia Department of Transportation indicated that the partnership should address ownership of information and ensuring that information was shared by all travelers. Respondents also expected that risk management and revenue should be defined within the public/private partnership framework. The extent of agency expectations varied depending on the level of experience each agency had in previous public/private partnerships, jurisdictional issues, and the needs of the individual agencies.

Data generation, management, and ownership are central to the success of the system. The public/private partnership needs to keep the creation and management of credible, timely, and accurate data the main focus of the effort. The Federal Highway Administration indicated that information security should be a consideration, where appropriate. Public agencies expect that the information provided will contain the full range of information needed so the traveler can make timely decisions and chose appropriate routing.

Data ownership is another area which the public agencies expect partnership agreements. Information supplied through the partnership needs to be disseminated across jurisdictional boundaries. The agencies plan that traffic-related information would be supplied to all travelers. The partnership would also define data utilization by the private sector and the mechanisms for revenue-sharing.

Public agencies currently have different arrangements concerning revenue-sharing. Turnpike agencies and authorities are very revenue oriented. Many turnpike agencies have existing revenue-generating agreements, but departments of transportation do not currently handle revenue in this manner. The agencies expect that the partnership would provide the guidance and framework implementing the mechanism for cost-sharing, as well as the sharing of risks, responsibilities, and rewards.

A major expected benefit gained through public/private partnerships is the opportunity to incorporate advanced technology in developing solutions to TIS and traffic management while sharing the risk of system cost, development, and maintenance. The ability to spread system cost across all members of the I-95 Corridor Coalition and the private sector reduces the cost impact and associated budgetary burden. Public agencies expect that a public/private partnership would provide for I-95 Corridor-wide maintenance and future system upgrades.

Seventy-eight percent of the responding agencies expect that the private sector will have a significant role in developing traveler information systems. Most agencies responded that public/private partnerships would be advantageous for both parties as long as the partnerships included clear definitions of responsibilities, good communication, and a sharing of risks and profits.

5.1.4.2 Private Sector

Expectations for public/private partnerships vary among the companies surveyed. Those directly involved in TIS at some level have high expectations and believe that the public sector is necessary for new products to evolve. Other companies are more hesitant, but interested if the programs are clearly defined. The following is a discussion of private-sector expectations regarding public partnerships.

+ Most companies assume that there is an important role for the public sector in TIS development. They recognize the public sector's expertise in and control of transportation facilities, rights of way, some surveillance methods, and most of the necessary data. These components reside largely in transportation and public-safety agencies.

+ Some private companies are looking to the public sector to provide research or capital-investment dollars to develop products that are not yet available or fully developed. In some cases, private companies are interested in public underwriting of certain communications equipment for information dissemination over a broad geographic area. So, for example, some companies suggested that if all radio and TV stations along the Corridor had access to satellite or fiber-optic systems, consistent, real-time, area-specific audio-visual information could be transmitted efficiently.

+ Some companies are more interested in public support for technology development, market research, and product testing. The critical assumption here is that access to the markets, whether automobile or transit, is achieved through public-sector institutions and facilities. The general sense among companies was that the market for TIS is largely untapped and still undefined. Few companies reported any significant market research. Perhaps they were less forthcoming in this area, not

being eager to share results. Nevertheless, there is a sense that companies are not certain how to define and reach the TIS markets.

+ Some companies, particularly those in electronic communications, were tangentially interested in TIS. They do not consider these services to be their primary product or function, but feel that they would enhance existing products and market base. Thus, broadcast media and cellular telephone companies do not feel TIS is necessarily a profit center in its own right, but rather an enhancement to their basic service. Media outlets demonstrate the added value of TIS by "paying " for it through donating advertising spots to the information suppliers.

+ There was a very high degree of unanimity among respondents on the question of technical compatibility along the Corridor. Virtually all respondents agree with the principle that systems should have uniform and compatible specifications, and that creating those was a function the public sector could influence heavily. This was an area where several offers of cooperation occurred. Private companies were willing to provide their technical expertise in forums created by the Coalition to solve the technology specification issues.

+ Following from the desire for technical compatibility was support for a Corridor-wide information system where users could tap into information about the particular area in which they were interested. Many respondents supported the concept of real-time, geographically specific, interactive, and, above all, user-friendly data which are easily accessible to the general public. This was very much a shared goal for TIS and one which most respondents considered a prerequisite for full public acceptance of TIS.

+ Perhaps most importantly, all the private-sector companies expect TIS eventually to turn a profit. Most information providers already report a profit on their services, whereas some of the high-end equipment providers and networked software developers are still in the product development stages. Electronic communications companies tend to consider TIS more as an enhancement, but would certainly be eager for a profit, were it available. Transportation companies consider TIS a possible means to improve operating efficiency and therefore profit. Trucking companies would be more interested in TIS if it included particular information useful to them, such as construction locations, alternate routes, weather, bridge load limits and clearances, and hazardous-materials routing. However, their main concern is that the costs of procuring TIS equipment are still too high to be justified on the basis of operating efficiency.

+ Whatever their relationship to TIS, however, all the companies will consider the question of public/private partnerships from the return-on-investment perspective. All respondents considered this a given when asked to rank issues related to working with the public sector.

+ Finally, although profit is clearly the underlying motivation for companies in the TIS business, all private-sector respondents were cognizant and supportive of the public-policy goals involved. Most responded that they wished to provide a public benefit through their products and services. Several went so far as to say that profit was not their primary or exclusive motive. They wished to assure a reasonable return on investment, while providing a useful public service.

Two fundamental conclusions emerge from our survey of the private sector's expectations:

+ First, the public sector has an opportunity to take the initiative to develop scenarios and opportunities for partnership with the private sector. The private sector is open to prospects and eager to participate, but they are uncertain how to proceed. The invitation and context must come from the public side.

+ Second, the public sector must recognize the private sector's profitability requirement. The private sector appears to be less suspicious of the public sector's goals than they are of its methods. The public sector must be equally accepting of the private sector's goal and work to streamline contracting and decision making so that achievements can occur on a reasonable timetable.

5.1.5 Willingness to See Portions of TIS Functions Privatized

5.1.5.1 Public Sector

The majority of public agencies surveyed were willing to see portions of TIS functions privatized within some constraints. The public agencies want to ensure that information is available to the full user public and that agencies which participate in revenue-sharing receive the appropriate return-on-investment or share of profits. Partnerships would be advantageous to both parties as long as

clear definitions of responsibilities, good communication, and a sharing of risks and profits were part of the partnership.

5.1.5.2 Private Sector

All private companies are, almost by definition, interested in the privatization of TIS functions privatized.

5.1.6 Public/Private Partnerships Anticipated or in Operation

5.1.6.1 Public Sector

Sixty percent of responding public agencies are currently involved with private organizations. Many agencies that currently operate traffic management systems in major metropolitan areas utilize some form of informal or contractual agreement to augment and complement their surveillance capabilities. Other agencies are in the planning stages of forming such arrangements, or, as in the case of the Delaware Department of Transportation, are willing to form partnerships but are waiting to be approached by the private sector.

Commercial traffic reporting firms hold the majority of arrangements with public agencies. Prominent companies like Metro Traffic, Shadow Broadcast, and Traffax Traffic Network are the most common. One or more of these three are used in most major cities throughout the Corridor (refer to Table 5-l).

Since companies like Metro Traffic operate their own aircraft and probe vehicles, their inputs can be invaluable to a publicly operated traffic management system. The aerial support in particular is significant since for most agencies the cost to operate and maintain an aircraft precludes its use. These companies are equally valuable to the public agencies in providing information since they can disseminate traffic and weather information to a broad range of users.

Table 5-1. Commercial Traffic firms and Locations in I-95 Corridor

State	city	Traffic Network Name
Connecticut	Hartford	Traffic Net
	New Haven	Traffic Net
	Fairfield County	Traffic Net
D.C.	Washington	Metro Traffic Control
	Washington	Shadow Broadcast Services
Maryland	Baltimore	Metro Traffic Control
	Baltimore	Shadow Broadcast Services
Massachusetts	Boston	Metro Traffic Control
	Boston	Smart Route Systems
	Springfield	Traffic Net
New York	Long Island	Metro Traffic Control
	New York City	Metro Traffic Control
	New York City	Shadow Broadcast Services
New Jersey	Rutherford	Shadow Traffic Networks
Pennsylvania	Philadelphia	Metro Traffic Control
	Philadelphia	Shadow Broadcast Services
Rhode Island	Providence	Traffic Net
Virginia	Norfolk	Metro Traffic Control
	Richmond	Metro Traffic Control

Companies like Bell Atlantic, NYNEX, Cellular One, Comcast, and AT&T supplement the incident reporting process by providing the communication infrastructure to allow cellular car phone users to, among other things, report incidents (e.g., '11). In addition, communication companies in many states are partnering with state DOTs and authorities to install communication networks. Public agencies share right-of-way in exchange for the use of newly installed fiber networks.

Very few, if any, of the "partnerships" reported by our public-agency respondents could be characterized as true partnerships, in the sense that assets, risks, expenses, and revenue are pooled. Most, particularly in the case of relations with traffic reporting companies, are informal, undocumented relationships, often involving *quid pro quo* arrangements that may be the seeds of true partnerships. Most of the rest are normal, contractor-client relationships. A few, such as the right-of-way sharing noted above, come close to true partnerships.

5.1.6.2 Private Sector

Several existing or potential "partnerships" were reported by the survey respondents. All of the information providers are already linked to both the public sector for gathering data and to various media and telephone outlets to disseminate the data. Ail of the respondents describe these relationships as satisfactory both technically and logistically.

Several respondents are working with state departments of transportation on a variety of transportation system management and TIS projects from data gathering, surveillance, and mapping to systems management and operation.

Also, there is an extensive tourism information partnership called Discover America, consisting of state tourism organizations, AAA, Navtek, Phillips Electronics, and many other companies. This system, when it is fully operationally, will provide mapping, directions, and information on ail aspects of tourism through kiosks along highways, in hotels, and at information centers. The motivation for each participant is slightly different: some are looking for a market for their equipment, some for their software, others are providing a valuable service for their subscribers, and the public sector is marketing their tourism destinations. Other potential applications for this kind of technology include detailed municipal mapping services for public-safety agencies.

One area where the private sector expressed interest in working with the public sector was in providing transit information. Several companies maintain that they have the technology to provide real-time information on electronic signs for bus and transit stops. These signs could alert the public to the location of the next vehicle and the expected time until it arrives. interest in partnering with the public sector on these products was very high. AAA also expressed an interest in expanding ifs transit, rail, and intermodal information. The increasing average age of

their membership is progressively leading to a higher percentage of subscribers who would prefer not to drive.

5.2 COMMERCIAL OPPORTUNITIES

A recent study by the Volpe Center[4] establishes three basic functions to the provision of Traveler Information Services. These functions: traffic and other data gathering: data processing and format; and information broadcasting provide a useful framework for the discussion of commercial opportunities for Traveler Information Services in the I-95 Corridor.

5.2.1 Data Gathering

Most traffic data now gathered within the I-95 Corridor are gathered through either public-agency efforts or commercial traffic reporting services. The growth in the number of transportation control centers and the surveillance systems which accompany these centers ensure that for the foreseeable future public agencies will continue to collect large amounts of traffic data within the Corridor. In most cases, these data are gathered for advanced traffic management applications like incident management and dissemination by variable message sign. In some cases, these collection efforts are supplemented by private-company collection efforts. Generally speaking, private companies which collect traffic data also sell the data, after it has been interpreted and reformatted.

Commercial opportunities in the data gathering function are probably fairly limited since this function by itself does not produce any value. There may be some limited commercial opportunities in the gaps that now exist in the Corridor data collection effort. Some public agencies have taken steps to privatize or contract out their data collection operations, although they continue to exercise control over the use of the data. The key to generating commercial opportunities from the collection of these data lies in the performance of the second identified function, data processing and format.

[4] Jane E. Lappin *et al. Op. cit.*

5.2.2 Data Processing and Formatting

Public agencies, when providing access to information they have gathered on traffic conditions, generally do not charge a fee. In addition, there is little processing of the information received by public agencies as they are not in the business of tailoring this information to specific needs. They will, however, often trade information with private companies who are in the information processing and distribution business. This public/private transfer of information is an area where numerous commercial opportunities may exist.

The types of arrangements that could be adopted for sharing of information gathered by the public sector range from a straight sale of the information to a "middleman" who would then process and format it for resale, to an arrangement where the information is given free of charge to the private entity in return for some particular type of dissemination of the information to the agency's constituency. In between these two extremes are an unlimited number of commercial options, such as:

+ Granting exclusive rights to the sale of certain information in return for operating the data gathering function, with conditions on how the information is disseminated.

+ Granting rights to use data gathered by the public sector in return for enhancing the data gathering operation.

One of the key ingredients in determining from an agency's point of view what approach to take when exploring commercial opportunities in the gathering and processing of data will be the agency's goals with regard to its constituencies. For example, policy objectives such as reducing congestion, increasing mobility, improving intermodal exchanges, and improving air quality require broad dissemination of the information the agency has developed, which may not be achieved by developing specialized markets that pay substantial amounts of money to access well processed and specific information. Some tensions may exist between public-policy objectives and private for-profit operations when it comes to information dissemination issues. This may result in commercial opportunities being defined as, "If you can meet our policy objectives you may have the right to access and resell our data."

The results of the surveys conducted with private-sector companies indicates a strong interest on the part of these companies in accessing public data for use in specialized applications.

5.2.3 Traffic Information Broadcasting or Retailing

Similar to the data processing and formatting function, most traffic information broadcasting services are privately operated. One notable exception to the contrary is highway advisory radio, which is generally a publicly run service. This is the function where an explosion of new technologies and approaches will transform the ways that travelers receive traffic and intermodal information. Some of the retailing techniques on the horizon or already activated to a limited degree include in-vehicle devices, personal digital assistants, computers, telephones, pagers, faxes and electronic mail (e mail). To a large degree, the commercial opportunities that exist in this area are similar to those described in the data processing discussion.

5.2.4 Riahts of Wav

Outside the framework of the functions as described above, a commercial opportunity currently exists for public agencies in the deployment of fiber-optic cables and other telecommunications infrastructure on their rights-of-way. A number of public agencies, including the Maryland State Highway Administration and the Massachusetts Highway Department are currently entering into agreements with private companies to allow use of their rights-of-way in exchange for use of the telecommunications facilities once they are installed. The l-95 Corridor, providing a continuous right-of-way through the most densely populated section of the United States, is clearly an ideal place to locate telecommunications infrastructure. This may be an opportunity for the Coalition to reduce costs of some of the TIS infrastructure and enhance the quality of data gathering and dissemination.

5.3 SCENARIOS

As discussed above, private companies are waiting for the public sector to take the lead if the latter truly wants to initiate partnerships with companies offering expertise in TIS. To that end, the

following scenarios are offered as starting points for defining options for public/private partnerships or privatization. These scenarios will be developed further in Task 6 **of** this project.

Contracting: This is the simplest scenario and by far the most common. It is not truly a partnership, but rather a vendor relationship where the public sector contracts to purchase goods or services from private companies. In transportation, this is and has been common for decades, as in infrastructure design and construction, which is almost exclusively bid out to the private sector.

Contracting for services previously performed by public employees: This is one of the most common definitions of privatization and one of the most controversial. It generally applies to service contracts at existing transportation agencies such as cleaning, maintenance, or repair work. For TIS, however, its application is uncertain, since most of the services required are not currently being performed by public employees. The possible exception is some surveillance tasks.

Contracting for and developing new services: This model is emerging in the TIS field, as public agencies begin to establish intelligent transportation systems. To achieve these new systems' goals, information and operations centers for the gathering and dissemination of traffic and transportation information are being planned and operated in several cases by private companies.

Collaboratlve effort to develop new products and systems: Both sectors would share in the risk and the benefit of a new product in the same way that private-sector partnerships currently operate. Both the public and private sectors would invest in products which would enhance public-policy objectives of reducing congestion and improving air quality, while producing a financial return for the investors.

5.4 REVENUE GENERATION

The viability of any and all of the scenarios considered for public/private partnerships rests on the premise that there will be sufficient revenue generated to offset product development costs and

produce net revenue. Various methods of collecting fees are currently in use or contemplated for the future. At present, methods include paid subscription fees (AAA memberships, commercial vehicle operators who subscribe to traffic information services), user charges (cellular telephone calls, cable TV basic rates), and advertising (radio, TV, ads on construction advisory faxes, and on information kiosks).

For the future, other possibilities for generating revenue include: selling data, leasing or trading space for electronic signs, interactive kiosks or other equipment, user fees, selling advertising linked to TIS, and potentially bidding out whole TIS operations and delivery to private sector entities.

5.4.1 Advertising

The most developed form of revenue generation from TIS so far is linking the service with advertising. Almost all the traffic information providers currently produce revenue by this means. The same is true for the media outlets who deliver the information. In fact, advertising spots have become the currency by which traffic information is traded. Although different information providers have different arrangements with particular media outlets, generally they all follow a similar pattern. The information provider company trades their traffic data for a certain number of advertising spots usually located around the drive-time traffic reports. The information provider then either resells these spots to advertisers, or uses the spots themselves to promote their services. Often both occur, the information provider producing and airing self promos during spots which were not resold.

Naturally, the value of these advertising spots varies with the specific media outlet and the specific time available. Different agreements also provide for a varying number of spots in trade for the traffic information. Whatever the particular arrangements, however, the traffic information providers are reporting a profit on their businesses to date, so this advertising barter arrangement appears to have a successful track record to date.

Selling advertising is clearly under consideration as a revenue source for other TIS applications as well. An obvious example is as part of information kiosks offering mapping, tourism, traffic and construction and intermodal information. Since a myriad of private companies offer services in this

area, there are doubtless commercial opportunities to be developed. Advertising may be a more profitable avenue than user fees, judging by the experience of TravTek in Orlando. This service produced jointly through AAA, equipment providers and a rental car company, offered in-vehicle navigation equipment which included GPS for routing, the Yellow Pages for services, and some real-time traffic information. After surveying users, AAA determined that they were very satisfied with the service, would be pleased to use it again, but were generally unwilling to pay very much to use it. Thus, one might conclude that at least for the present, advertising would be a more profitable source of revenue than user fees.

5.4.2 Franchises and Concessions

One area where the public sector has considerable experience with the private sector is bidding out concessions on public facilities. Highways, airports, and transit companies all commonly contract with private companies to provide services such as food, retail, telecommunications, maintenance, and other services. This might be a model for TIS as well. Individual agencies or groups of agencies such as the I-95 Corridor Coalition could choose to create bid opportunities by designing a request for proposals for TIS. Such an RFP could be broken up into natural geographic areas, based on population, large media markets, and/or specific services desired.

5.5 FIRST STEPS: REQUESTS FOR INFORMATION AND PROPOSALS

The early development of public/private partnerships for the provision of traveler information would benefit from a two-step procurement process: first, Requests for Information (RFI), followed by Requests for Proposals (RFP).

5.5.1 Reauests for Information

One proven method of measuring the feasibility of commercial opportunities in the Corridor is through the issuance of RFIs. These requests can be either general or specific in nature, and often provide the guidance necessary to progress to the next level on complicated questions of

interest and procurement. Putting an RFI out ignites private-sector interest, and harnesses the creativity of the private sector in how commercial development can be structured.

5.5.2 Requests for Proposals

Based on the survey data gathered, several components for the RFPs would be desirable:

- The technical specification should be clear and consistent between geographic areas. This consistency is precisely one of the objectives of the Coalition.
- The public sector should take the lead in defining the services it needs in order to meet its public-policy objectives.
- The private sector should be asked to respond based on the best technical methods for achieving these goals, as well as on the possibilities for both generating and sharing revenue.

Currently, when public sector agencies choose among competing bids for other concessions, the return to the agency is a key component in making the decision. In the area of TIS, however, knowledge is much less developed about how the market will respond, so financial projections might have to be phased over time with a profitable return projected out to some point in the future.

The public agency could then choose among qualified bidders those proposals which best combine the three key components of a successful system: ability to achieve the policy goal, best technical system, and best potential return.

6. SITE VISITS

Site visits were conducted to supplement the existing TIS systems inventory data gathering process and to gain insight into operations of existing TIS in the Corridor. The following criteria were used to select sites:

+ Operational TIS capability.
+ Use of advanced or innovative technology.
+ Integration with an advanced traffic management system.
+ Interfaces to other public or private systems.
+ Modes of system access (e.g., TV, telephone, pager, computer, etc.).
+ Coverage.

Table 6-1 shows the sites that were visited.

6.1 METRO TRAFFIC NETWORKS

On Thursday, December 1, 1994 members of the Loral Team visited Metro Traffic Networks' headquarters for traffic broadcasts in the Washington, D.C., metropolitan area.

The tour was conducted by John Frawley, Director of Operations for the Northeast U.S. (comprising Norfolk, Richmond, Washington, Baltimore, Boston, and Paris). Later, Mike Morrison, Director of Operations for the Washington center, joined in on the tour. Metro's newly designed control center is the most advanced center Metro operates and will be the prototype for future upgrades throughout the Corridor. The following is a capability summary of Metro's facility.

Table 6-1. Sites Visited

Site Name	Location	TIS Product
Metro Traffic Control	Chevy Chase MD	Commercial traffic reporting service
Shadow Broadcast Services	Philadelphia PA	Commercial traffic reporting service
Philadelphia International Airport	Philadelphia PA	Multi-User Flight Information Display System (MUFIDS)
Montgomery County TMC	Rockville MD	Cable TV access to CCTV data with audiotex supplement
INFORM	Hauppauge NY	VMS, HAR, and VTIP systems
TRANSCOM	Jersey City NJ	HAR, clearinghouse for traveler information
Maryland and Chesapeake House	Aberdeen and Perryville MD	Tourist information centers, public kiosks

6.1.1 Surveillance

There are aircraft operating simultaneously during good weather conditions. Aerial surveillance is performed during peak hours (e.g., 6 a.m.–9 a.m., 4 p.m.–7 p.m.). Planes fly in a defined circuit around the Washington area. Aircraft are manned normally with one pilot and one traffic reporter. In some cases, reports are provided to radio/TV stations directly from the aircraft; in others, people located in the studio conduct the broadcasts. In some cities (i.e., NY City, Boston) helicopters are used. Aircraft are equipped with two-way radio/voice communications only. Video cameras are not used on aircraft.

Employee vehicles (pseudo probes) with two-way radio/voice are sometimes used in conjunction with aerial support, but are generally used when aerial surveillance is not feasible (e.g., rain, fog). Probe vehicles are manned by Metro employees; private citizens and others are not utilized.

The control center is equipped with four dedicated telephone lines for receiving information from motorists via Bell Atlantic cellular *JAM. Calls are not free to the caller; thus, the demand is very manageable and reliable. Metro, however, desires that calls be free to increase the amount of surveillance sources. *JAM is also used to give traffic reports and route guidance to cellular users. In some cities, these calls are free to the traveler.

Scanners are also used to detect incidents by listening to various frequencies (police, fire, etc.).

Metro has working relationships with Virginia Department of Transportation (VDOT) and the Montgomery County, Md. TMC to share traffic data. Plans are in place to receive a feed of live video from the cameras deployed in Montgomery County. This information will then be provided to TV stations. Currently, Metro has several TV monitors that are dedicated to viewing Montgomery County's Cable TV 55. Cable TV 55 displays video data and audiotex continuously. The imagery from all cameras is displayed, along with their locations, in a video tour (cyclic) fashion. It was pointed out that working relations with public agencies in the MD/D.C./VA region work well. In other cities in the Corridor, however, it was pointed out that improvements in coordination and cooperation are necessary. Two problems were noted:

+ Public agencies are reluctant to coordinate, communicate, or cooperate with the private sector due to potential conflicts of interests.

+ Metro feels that information obtained from public sources may not be as accurate as Metro's information, Metro in some instances has little confidence in the integrity of information provided by public agencies. In Metro's, the cause for this is lack of accountability by public agencies to report accurate information to travelers. 'If Metro was to report inaccurate data, the contract would be canceled that day."

For competitive reasons, Metro and Shadow do not exchange data or listen to each other's band on scanners. In fact, it is Metro's policy that if someone is caught listening to Shadow's frequency they will be fired.

6.1.2 Traveler Information

Information is provided to 35 various local radio stations and five local TV stations in the Washington metropolitan area. In most cases, during peak hours, traffic reports are given every 1 O-30 minutes. The traffic reports are tailored to the needs of a given radio or TV station. The TV or radio station decides when, how frequently, and what type of information will be reported. In fact, Metro has a silent partner relationship with requesting clients. That is, Metro's name is never used thereby giving the impression that the report comes directly from the radio station itself or its resources (e.g., aircraft).

Metro also sponsors “Road Watch America”, which is an up-to-date, all day/night traffic report for truckers. It is the same service that is provided to all other users, except truckers receive special books with Metro station affiliates in the U.S., on a state basis.

6.1.3 Operations

Metro in Washington, D.C. operates 24 hours a day, 365 days a year and employees 30 people. Staffing of the system is arranged such that:

+ Fifteen people are in the studio (one to two collectors of information, one operations manager, 10-12 traffic broadcasters/reporters).

+ Four employees are in aircraft or driving probe vehicles. In D.C., three aircraft fly; two with one pilot only and one with one pilot and one reporter.

The typical operation is to have one or two people collect traffic surveillance information from the sources identified above. These people are located in the middle of the studio and are referred to as directors of information. The director does all information-gathering activities and either shouts out news or enters it into a computer. The director’s station is equipped with several police and fire scanners, radio for Metro’s aircraft, telephones, and a computer for entering verified traffic incident reports. Event information is entered into a computer in journal format:

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[time of event] [tag identifying location, priority, sequence, and
severity] [type] [source of information] [free form textual
description of event]
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For example:

```
9:00 a.m.  291355 Construction
Air - left lane, 295 south at Powder Mill Road closed due to
repair
4:50 p.m.  123499 Incident
TOC- Overturned truck at the intersection on outer loop of 495 at
355 exit, right two lanes blocked
```

The information is entered in journal and prioritized and replicated to Macintosh computers at reporters' stations. Metro's name for this system is STUDIOTRAK. This information is then the basis for broadcast traffic reports by about 10 traffic broadcasting/reporting specialists. Normally, each reporter is responsible for broadcasting to a number of TV and/or radio stations. Reporters manage their own on-airs and customize traffic reports to the needs of each radio station. Each reporter's station is equipped with a Macintosh computer, one or two monitors for TV stations and for cable TV video and traffic information, headphones, radio mike, telephone, and a digital switcher.

STUDIOTRAK' s journal format shows current and recent events (within last 6 hours). Journal is straight text, not stored in a database and not designed to be processed. Future plans include exchanging information between Baltimore and Washington. This capability will grow to all Corridor studios.

In addition to broadcasting traffic reports, Metro Traffic Networks also provides news broadcasting services to radio and TV stations. Metro provides traffic reports to client TV and radio stations in exchange for advertise slots. Metro makes most of its money by selling these advertising slots to various companies. Metro estimates that in an average week they reach 80% of all commuters through advertising on their 35 radio and 5 TV stations.

6.2 SHADOW BROADCAST SERVICES

On Tuesday, December 6th, 1994, members of the Loral Team visited Shadow Broadcast Service's traffic control center for greater Philadelphia. We chose Philadelphia because, according to Shadow, it is their most advanced operation.

We visited with Jim Battagliese, Traffic Operations & Programming Director. Jim pointed out that Shadow Broadcast Services in Philadelphia is known as Express Broadcast Services, since Metro owns the rights to the Shadow name in the city. Express is very similar to Metro Traffic Networks (Section 6.1) with the following key differences:

+ More dependence on CCTV.

+ A more sophisticated database.

The following is a capability summary of Shadow's facility.

6.2.1 Surveillance

Shadow depends heavily on CCTV cameras that they own at various high points around the city. They have five or six in place, with another one planned to reside atop a smokestack. In addition, they also have slow-scan (i.e., snapshot) cameras.

Like Metro, Express uses aerial surveillance. Express uses two airplanes (during peak hours), each with a single crew, who reports events by two-way radio/voice to the producers. Monday morning and Friday afternoon, Express uses a helicopter as well: a Philadelphia Highway Patrol officer normally sits in the helicopter. The helicopter, although more maneuverable, is eight times more expensive to operate than the airplanes. No traffic reports are provided to TV or radio stations directly from the aircraft.

Express has two-way radios installed in various taxis and limos, and in CVS drugstores' courtesy patrols. Reports of incidents and traffic congestion are called in frequently. Express offers "free plugs" in exchange for the service.

Express has a relationship with LEARN, which is an association of radio-buff firefighters and police, who carry two-way radios when they're off duty.

Scanners are also used to detect incidents by listening to various frequencies (police, fire, etc.). Express depends on a good official relationship with police and fire departments. Their relationship seems particularly good with the Philadelphia Highway Patrol and the Pennsylvania State Police. They have a distant relationship with the Pennsylvania Department of

Transportation (PennDOT). When Express installed their cameras, they offered a connection to PennDOT, but this has not been taken up. It was interesting to note that PennDOT has put up cameras that geographically overlap with Express' existing CCTV. We speculate that the reason for this is that both agencies need to control the cameras.

Express uses a 7-digit telephone "tip-line" number for cellular call-ins. Three lines are set aside for this.

For competitive reasons, Metro and Express do not exchange data or listen to each others band on scanners.

6.2.2 Operations

Like Metro, Express operates 7 days a week, 365 days a year.

The producers' desk is topped by six TV monitors. The producers enter information about traffic events into a FoxPro-based log. All dissemination goes through this database. The producers' desk holds the usual scanners, radios, and telephones.

Event and incident information is logged in the following format:

```
[time of entry or update] [priority] [road] [free form textual
description of event]
```

For example:

9:00 a.m. 9 195 left lane, I-95 south at exit 25 closed - fender bender

The free-form text uses guideline-specified abbreviations. Reporters are trained to understand the abbreviated format. As well, the events are sorted by region, and each region is shown in a different color. Because data are sorted by region, each radio and TV station that receives reports

is encouraged to specify regions of interest to them. When a broadcaster retrieves the information, the name of the station is entered in the system; the system then automatically filters out irrelevant data. Once the extraction is made for a particular station, the events are sorted by: region; priority; time. Also, the system will automatically flash events that are older than 20 minutes and drop ones >30 minutes old. Finally, the producers can log into the system with user=all and retrieve all the data (i.e., nonfiltered).

6.2.3 Traveler Information

Express reporters work in soundproof booths. Though the reporters are encouraged to spend time in the main room, the reporter we watched read the traffic report from the on-screen log. This is quite a bit different than Metro's approach, where they believe in creating a traffic atmosphere by having reporters sit around the producer's hub. As described earlier, the Express events that are displayed are customized according to the station. Some stations desire the status of New York river crossings, others are interested in the immediate Philadelphia area. Shadow broadcasters report to one TV station and 22 radio stations in the metropolitan area. Express, unlike Metro, advertises its name with the traffic report.

The local cellular company, Comcast Metrofone, pays to receive a version of the log that spells out the abbreviations; hence the emphasis on "standard" abbreviations. Comcast is not in the same building, and therefore the information is electronically shipped to them. At the direction at Express's parent, Shadow, traffic reporting abbreviations are being standardized countrywide so that information can be shared among Shadow offices. Corncast's operators will give callers on their ● 41 1 information line information about traffic, using the information from Express. As well, anyone desiring directions is switched over to Express' producers' desk, which uses Automap's product to route drivers taking traffic into account.

Express is an advocate of selling its database to resellers.

In addition to broadcasting traffic reports, Express also provides news broadcasting services to radio and TV stations. Express is explicitly interested in in-vehicle traffic information.

Shadow has other offices in the Corridor: New York; Rutherford, New Jersey: Baltimore: and Washington, D.C.

Again, for competitive reasons, Shadow and Metro do not share information.

6.3 PHILADELPHIA INTERNATIONAL AIRPORT

On Tuesday, December 6, 1994, members of the Loral Team visited Philadelphia International Airport. We choose Philadelphia International Airport to visit for several reasons:

+ They were the most responsive of all major airports in the Corridor with respect to our TIS surveys.

+ They are an intermodal airport (e.g., connections with SEPTA and Amtrak).

+ They are not a major airport hub for any airline, and over 70% of all flights are either origin or destination (not connections).

+ They operate an integrated airline information display system.

We met John J. Hanssens Jr., Public Information Coordinator, and Bob Cusick, Assistant Airport Manager of Maintenance and Electric. The airport is a self-supporting agency that is sponsored by the City of Philadelphia, but which finances itself. Revenue streams are mainly from airport landing fees and from tenant fees. Additional revenue streams are from parking, car rental agencies, and from taxi, limo, and bus road access fees.

The subject of our visit was the MUFIDS, provided by Infax Systems. It collects real-time information about arrivals and departures for all flights, and displays it on monitor banks around the airport. Output is available in both video and text formats. At central locations (e.g., main concourses), it shows 12 screens displaying arrivals and departures, sorted by: city (of origin or destination, as appropriate); time; and airline. Within terminals, the screen displays only those flights arriving or departing from that terminal. Outside at the curbside, monitors display arrival

data. In total, there are 92 screens available throughout the airport. This will expand to over 500 in the future. According to Mr. Cusick, Infax and ComNet are the two major vendors of such systems in the U.S. Both vendors supply a proprietary-based solution, in terms of hardware and software.

Flight information is continuously electronically uploaded from the individual airlines' computers. The information is real-time. Small airlines without on-station computers will call the Airport Communications Center, where updates are manually entered. The screens show as much as will fit in up to 12 screens. In practice, this is all flights within 2 hours, and no farther out than 22 hours. In addition to the banks of monitors displaying arrivals/departures, screens and panel space for advertisements have been allocated. In addition, there are free-form text screens advertising airport services. In the future, touch screens will be used for more user-specific information.

The service is not unique; BWI, Houston, and others have similar systems. These systems are integrated and operational and are potential sources of information for the Corridor TIS. Several other airports in the Corridor have nonintegrated flight information systems. That is, each airline is responsible for displaying their own arrivals/departures. Mr. Cusick is not interested in disseminating the information without receiving a fee. "We spent over 3 million dollars on this system, and will not give out information for free". In fact, Mr. Cusick emphasized how hard he had worked to capture and integrate all airlines information and to get them to relinquish control of their independently run systems. Now, all airlines pay the airport to maintain and advertise their piece of the overall system. According to Mr. Cusick, it is much more cost-effective to have only one entity maintain this information instead of several airlines doing the same job. Moreover, an independent enterprise must run the system, so as not to give preference to any one airline. Mr. Cusick has already sold the information to local hotels and car rental agencies in the area.

Additional. miscellaneous information obtained from the site visit is documented below:

+ PHL is the 23rd-ranked airport in the U.S., measured by the number of passengers they service. It competes with Newark, BWI, and all airports within easy driving distance. Out of this discussion came an interesting point. Airports, like Pittsburgh, that are airport hubs, where only 30% of the passengers are starting or concluding their trip, are "weightless" in a transportation corridor, not major intermodal points. PHL, on the other hand, has 70% of arriving/departing passengers as either their final

destination or starting origin. Hence, this 'medium"-sized airport has a major impact on the l-95 Corridor.

- Mr. Cusick is relatively uninterested in receiving congestion information. Aside from good working relations on the maintenance of the access road, they have no relationship at all with the Pennsylvania Department of Transportation. One angle that might work is to make PHL more traveler-friendly.

- PHL has information booths in each of the five terminals (at the gate level) to provide information to the public. The booths are staffed 16 hours daily by trained information representatives who provide directions and other types of information.

- Because PHL owns, operates, and maintains access roads leading to the airport they also operate their own HAR and CCTV system. HAR is used in the mornings to assist airport-bound passengers by providing information on parking facilities, airline locations, road conditions, etc. The CCTV system is used for airport runways and airfield surveillance and security, although one can see major freeways. Occasionally, cameras are used for freeway monitor purposes.

- SEPTA trains connect PHL and Amtrak. Horizontally scrolled LEDs provide information for potential SEPTA users. On the SEPTA platforms are monitors for the next arriving/departing trains. This information is provided by SEPTA over modems.

6.4 MONTGOMERY COUNTY TMC

On Thursday, November 17, 1994, members of the Loral Team visited the Transportation Management Center of Montgomery County, Maryland. Montgomery County, Maryland's most populous county, is part of metropolitan Washington, D.C. The tour was conducted by Gene Donaldson, ITS Project Development Coordinator for Montgomery County. Mr. Donaldson emphasized that the facility is used for both traffic and transit management. Thus, a slightly different use of the ***TMC*** acronym, which historically describes only traffic management centers. It is envisioned by Gene that the same TMC and supporting workstations and software will be used by transit and traffic engineering, operations, and planning departments; thus, a totally integrated system.

The Montgomery County TMC is a surface-street management facility, although CCTV monitoring is also used along I-270. The facility uses many of the latest ideas in state-of-the-art Advanced Traffic Management System (ATMS)/ATIS technology and traffic engineering disciplines. The following is a technical summary of the TMC characteristics.

6.4.1 Surveillance

Montgomery County uses the following surveillance methods:

- 16 existing CCTV cameras (50 by 1995) with plans to grow to as many as 200. Montgomery County envisions increased use of cameras for the purpose of automated incident detection through the use of machine vision. They also envision separate fixed cameras for machine vision and other dedicated cameras for manual control (i.e., zoom/pan/tilt).

- 3000 sample detectors (i.e., loops).

- Aerial coverage from a county-owned and operated Cessna 172 aircraft with "live" video and audio transmitted via microwave communications directly to the TMC. The aircraft is used primarily for incident management.

- Automated incident detection system using loop data. Cameras are also used for incident detection and verification. They use police radio now, with plans to replace this system with a police Computer-Aided Dispatch (CAD) system.

- They are testing Autoscope.

- Autoscope receives probe data from the D.C. Cellular Project receiving site for D.C. The Cellular Project is used to provide probe data (e.g., link speeds, travel times).

- They plan to implement a volunteer citizen probe report program called "Traffic WATCH" that will use trained citizens to report incidents and traffic conditions.

6.4.2 Control

The characteristics of Montgomery County's control system are:

- 650 Traffic Signals with a capability to grow to 1500.
- VMS is not currently installed, although in the future a few small VMSs will be implemented.
- Comtrac control algorithm running new or old National Electrical Manufacturers' Association (NEMA) and 170s controllers, capable of running in traffic-responsive or time-of-day mode.

6.4.3 Communications

The communications infrastructure for the TMC includes:

- 400 miles of existing twisted pair coaxial cable that is being upgraded to fiber optics; the upgrade will supports voice, data, and video data exchange.
- 46 count Single Mode Fiber Optic (SMFO) backbone with 24 count feeders that will support county plans to go with Synchronous Optical Network (SONET) and Advanced Traffic Management (ATM) standards in the future. SONET support expected by the summer of 1995.
- Plans to expand the fiber network to the entire county in order to link other public agencies together (e.g., schools, police, fire, rescue, etc.).

6.4.4 Control and Information System Characteristics

Montgomery County uses the following processors and software for transportation management:

- Data General minicomputers are used for data acquisition.

- A Sun SPARCstation 10 running Solaris 1, with 4 Gigabyte external storage. They have plans to acquire a SPARCstation 20 and/or Server 1000.

- Informix relational database for storing 1, 5, 10, and 15 minute count data; every 1 minute each detector's 1-minute count data get loaded into the Database Management System (DBMS). This can be customized to 2 minutes, 5 minutes, etc. Several months of historical data are obtainable from the DBMS.

- Fairchild's Multimap Geographic Information System (GIS) product, allows panning/zooming of a raster-scanned Alexandria Drafting Co. (ADC) map for Montgomery County. The system is capable of using other map databases (e.g., TIGER, Etak), but, ADC is the county standard. Various raster layers are used to display lower level map details [e.g., aerial photos digitized (digital ortho) and displayed in Tagged Image File Format (TIFF)]. The TMC can also access the county's ARC/INFO GIS. They have plans to support a vector-based map.

- Motif graphical user interface with red, yellow, or green dots to indicate Loss of Signal (LOS); color coded links are planned.

- Logical reconfigurable links are defined between physical detection stations.

- Access to digital tape archives containing several years of historic traffic data.

6.4.5 ATIS Features

The Montgomery County TMC supports the following TIS:

- Traveler's Advisor Radio (TAR) 590 AM, located at Rt. 29-95 1070 AM.

- Cable TV display of video and audio TAR on dedicated county channel 55 "Traffic Channel"; the same TAR message is heard on TV and in vehicle. News Channel 8, WUSA-TV, and WRC-TV interlace to TMC and have direct access to live video imagery. In the future, cable 55 will be provided with the TMC's color-coded link map

in addition to the live video that currently receives. Other counties have already expressed interest in receiving Montgomery County's video.

+ Traffic reports to radio stations.

+ Plans to provide a dedicated server for information access only (e.g., Mosaic, Modem, etc.).

6.4.6 Transit Capabilities

The Transit fleet that Montgomery County manages includes the following:

+ 250 buses in the Montgomery County Transit ("Ride On") fleet. GPS to track 70 or 80 buses for schedule adherence. Although transit vehicles will not be used as probes, behind-schedule buses will be an indicator that congestion exists.

+ There are plans to provide information to transit travelers to increase rtdership on Ride On buses.

4 Support for signal priorities for transit and preemption for emergency response.

6.4.7 Operations

The TMC operates in the following mode:

+ Operates 24 hours a day.

+ Manned with two operators during peak shifts.

+ Operation concept is to automate as much as possible and use fewer, but higher skilled operators.

+ Coordinates with Metro and Shadow Traffic Control.

+ Member of Maryland's Chesapeake Advisories Routing Traffic (CHART) program. CHART is intended to become a state-wide traffic management system that will demonstrate a new level of coordinated traffic management facilities.

+ Member of Washington Capital Area Operations Management Team which includes, among others: Virginia Department of Transportation, District of Columbia, Maryland State Highway Administration, police, fire, and rescue . This organization is designed to support regional traffic management activities.

Aside from the advanced features on display, the Montgomery County TMC is also unique in that it and Baltimore County are the only county-run TMCs in Maryland that control city signals. In addition, the system is the result of over 14 years of improvements and lessons learned in traffic engineering. The system was designed by the County itself and a contractor was later selected to implement the solution.

6.5 INFORM

On Monday, December 5, 1994, members of the Loral Team visited the INFORM traffic control center in Long Island. Robert "Bob" Rosendahl, Director of INFORM, and his assistant Joe Contegni gave us the facility tour.

INFORM is the nation's largest, most advanced traffic information system for motorists. INFORM is designed to help the motorists improve their travel times on the Long Island Expressway (I-495), where morning westbound and afternoon eastbound traffic can be the toughest. The INFORM system covers the "northern corridor" through Nassau and Suffolk counties and a small portion of Queens County. In addition, the southern corridor is planned to be added to the system. INFORM's major output device to travelers is VMS. In all, 101 VMS are currently operated. In addition to the Long Island Expressway, the system also provides information to motorists on the Grand Central Parkway and the Jericho Turnpike.

In addition to the VMS, an ATIS graphical software package exists and is sold to interested customers. The VTIP is a by-product of the INFORM project. VTIP is a piece of ATIS software that

displays graphically or in text form to cable TV, regular TV, or radio. The VTIP software collects speed information from INFORM; displays the current speed information with color-coded links; and automatically transfers information through modems. The software runs on a IBM PC, with a color graphics monitor and was written in C++. VTIP provides several screens, including: a color map, a text screen, a travel times screen, a delays screen, and a travel summaries. VTIP can function in call-in or call-out modes. In the call-in mode, your computer calls the VTIP computer for current information. In the call-out mode, the VTIP computer calls your computer and gives it information. The VTIP software sells for about $200 and is used by about 40 customers. Most of the customers are information broadcasters (TV and radio stations), although it is also in the lobbies of some public buildings. In some cases, direct, dedicated lines have been provided to customers (e.g., cable TV, New York City Department of Transportation).

6.5.1 Surveillance

The INFORM surveillance system has the following characteristics:

+ 2069 loop detectors (polled every 60 seconds, algorithms updated once per minute), generally on the Long Island Expressway. Because of performance and data quality problems, they are moving away from loops. They plan to make more use of CCTV and infrared sensors. They are conducting tests of infrared, radar, microwave, acoustic, and machine vision as part of the Early Deployment Study. In addition, an Intelligent Vehicle Highway Systems (IVHS) study is underway that includes the southern portion of Long Island adjacent to the INFORM corridor; this may expand INFORM.

+ There are currently 34 color CCTV cameras and plans to install 13 more.

+ INFORM dispatches a service patrol called Highway Emergency Local Patrol (HELP).

+ 22 CB monitors, though, CB monitoring is rarely used.

+ 3 Scanners on police frequencies.

+ Most incidents are detected by police telephone calls, scanners, and Metro Traffic Networks. Loops are used, but the incident detection algorithm is not reliable.

6.5.2 Control

The INFORM system consists of the following control elements;

+ 101 VMSs, with plans to implement a HAR system.
+ 75 ramp meters.
+ 133 signalized intersections.

6.5.3 Operations

The operational characteristics of the system are:

+ Digital Equipment Corporation (DEC) VAXstations 4000s with personal computers for operator workstations (generally about two operators). The control system is an enhanced version of Urban Traffic Control System (UTCS) bundled with JHK's System 2000 product.
+ INFORM is operated by the private sector (Parsons Brinkerhoff in association with Dunn Engineering Associates) 365 days a year.
+ There is very close cooperation with Nassau and Suffolk county police forces. Their procedures include keeping INFORM informed. There is less cooperation from the State Police and little cooperation from New York City police.
+ Each town in the coverage area has its own fire department resulting in a low degree of coordination.
+ Long Island, New York City, and downstate (Westchester and adjacent counties) systems will in the future communicate with each other and trade information.
+ The operator's console consists of many monitor/keyboard combinations for each separate system. Ultimately, all will be integrated through workstation screens.

6.5.4 Traveler Information

+ The "VTIP" product is used by about 40 licensees. Output from VTIP is displayed on local TV channels and has been installed for the county police, some shopping malls (e.g., lobbies), and radio stations.

+ Information is faxed to five radio stations. Operators manually fill in the form.

+ Metro Traffic Networks and a local radio station, WALK, provide INFORM traffic reports. Metro operates an airplane, and WALK operates a helicopter. Airborne traffic reporters use the INFORM center when they can't fly.

+ Operators compose VMS messages manually according to in-place guidelines.

+ There are plans for a HAR system.

+ 1-800 ROADWORK is used for disseminating construction reports.

+ Long Island's only newspaper is Newsday. Newsday is working with Prodigy to provide online INFORM data (e.g., construction reports).

6.6 TRANSCOM

On October 13, 1994, members of the Loral Team visited TRANSCOM. At TRANSCOM ,we met with Tom Batz, Manager of TRANSCOM's Technology Department, and Bernie Wagenblast, Operations Manager. We were first given a tour, led by Bernie Wagenblast, of the TRANSCOM facility and an overview of TRANSCOM's operation. Tom Batz then gave us an overview of TRANSCOM's future technology projects.

6.6.1 Operations Overview

From our tour of the facility, it is apparent that TRANSCOM is one of the most unique traffic management systems in the U.S. Factors that contribute to the uniqueness of TRANSCOM include:

+ It demonstrates that a variety of public agencies representing different jurisdictions can work in a cooperative manner and provide substantial benefit to the traveling public. The member agencies include:

  - Connecticut Department of Transportation
  - Metropolitan Transportation Authority (MTA)
  - New Jersey Department of Transportation (NJDOT)
  - New Jersey Highway Authority
  - New Jersey State Police
  - New Jersey Transit Corporation (NJT)
  - New Jersey Turnpike Authority
  - New York City Department of Transportation (NYCDOT)
  - New York State Department of Transportation (NYSDOT)
  - New York State Police
  - New York State Thruway Authority
  - Palisades Interstate Park Commission
  - Port Authority of New York & New Jersey (PANYNJ)
  - Port Authority Trans-Hudson Corporation (PATH)
  - Triborough Bridge & Tunnel Authority (TBTA)

+ It demonstrates that substantial benefit can be achieved with the use of relatively simple technology.

The primary purpose of TRANSCOM is to serve as a clearinghouse for travel information. Essentially, TRANSCOM receives travel information, such as construction activities and incident data, and makes sure that those agencies requiring the data receive it. Interestingly, TRANSCOM does not have any surveillance capability, it relies on information provided by the agency responsible for the operation of the asset.

The control center is continuously staffed by two operators who receive traffic status data through a variety of communications media that include the telephone, two-way radio, and facsimiles. The operators are also provided with monitors that display the Weather Channel and the approaches to the Holland, the Raritan River bridge, the intersection of Route 4 and 17. When a change in the status of the traffic network is detected, the operator looks up the appropriate Standard Operating Procedure (SOP) in a PC-based database. These SOPs are agreed on by all of the member agencies before they are used operationally. It was pointed out to us that before any SOP is used, it must have the unanimous agreement of each of the agencies. The output of this database is primarily a list of agencies and individuals that should be contacted. In addition to notifications to the member agencies, TRANSCOM also notifies other organizations such as Shadow Traffic, departments of transportation from non-member states such as Virginia, and to the I-95 Corridor Coalition.

As an example of the use of simple technology in the control center, TRANSCOM has a problem with exactly identifying links within the area. For example, a particular location may have several names. TRANSCOM's solution to this problem was to implement a simple map system that consists of the Rand-McNally Road Atlas on Compact Disk (CD). This allows the operators to perform searches using keys supplied by the person reporting the incident. The operator can then manipulate the map ("zoom") to locate the area in question.

Integration of TRANSCOM's System for Managing Incidents and Traffic (TRANSMIT) was in progress during our visit. This system leverages the Electronic Toll and Traffic Management (ETTM) standard developed for the E-Z Pass automated toll collection into a system for using the transponder-equipped vehicles as probes. When the field operational test is complete, an 18-mile section of the New York State Thruway and the Garden State Parkway will be used for evaluating the probe vehicle system. Farradyne Systems' MIST 2.0 product is the platform collecting the probe data and performing incident detection.

Adjacent to the control center is a small recording studio that is used for developing and transmitting HAR messages. The interface to the various HARs is through a dial-up modem.

6.6.2 Future Projects

TRANSCOM is in the process of implementing a video switching system. In this system, it is anticipated that TRANSCOM will serve as the video distribution hub; all video from the member agencies will be routed to TRANSCOM, who will then switch the video to those agencies requiring it. In the final system, receivers of the video will be able to receive the output from any camera, but will be unable to control it.

The **Alternate Bus Routing System** is in the prestudy phase. The proposed purpose of this system will be to promote intermodalism by relaying traffic information to the transit agencies for the purpose of optimizing bus routing.

SATIN is a proposed traveler information system. In this system TRANSCOM is anticipating installing from 3 to 7 kiosks at key transportation locations to provide traveler information to the public. There is the realization that many of TRANSCOM's member agencies have an interest in providing kiosks designed for **use** by the general public for the purpose of trip planning. TRANSCOM intends to conduct a study that in many ways mirrors our activities under the I-95 TIS project. Specifically, they are interested in developing an understanding of what the TIS needs are for the member agencies, level of participation in the operation of the system, methods for financing the system, collection of revenues, and distribution of profits.

Finally, based on the results of their Regional Architecture study, they will be developing a system architecture and design for expanding the system to cover the metropolitan region.

6.7 TOURIST INFORMATION CENTERS

6.7.1 Maryland House

On Tuesday, December 6, 1994, members of the Loral Team visited Maryland House, a tourist information center on I-95, north of Battimore, near Aberdeen, Md. There is signage on t-95 indicating the availability of Traveler Information, Business Services, Automatic Teller Machines (ATM) including Cirrus, MasterCard, and Most. Fax and phones are also provided. The lower level of the facility is dedicated to restaurants and rest moms; apparently operated by the Marriott. The upper level is a dedicated traveler information center and is operated by the Maryland Transportation Authority. In fact, during our visit we met Howard Moore, assistant administrator of the Maryland Transportation Authority and Project 8 TRC member. This service center, the busiest in the U.S. according to Mr. Moore, with 6-8 million visitors/year, is owned by this authority. The other service area, closer to the Delaware line, is owned by the state's Office of Tourism.

Maryland House has fax machines, telephone rooms, and brochures for attractions throughout the I-95 Corridor. In addition, there are two horizontally scrolled LEDs that display traveler information. Mr. Moore stated that he views his customers as Corridor travelers. By contrast, other service areas give only in-state information. The center is self-supporting. The upstairs operation generates revenue from its lottery agency and advertisers (e.g., hotels that share revenue). In addition, the center has an electronic travel board which has the following features:

+ Regional map of the entire I-95 Corridor.

+ Video touch screen.

+ Hotel panel with telephone for direct connections to participating agencies.

+ Information panels for attractions and points of interest and other types of services.

+ An electronic message center with "road alert" indicator lights for construction and roadway incidents due to accidents or inclement weather conditions.

Refer to the following paragraphs for a description of public kiosks in use in the Corridor and an illustration of the kiosk in use at this location.

6.7.2 Chesapeake House

On Tuesday, December 6, 1994, members of the Loral Team visited Chesapeake House. Interestingly, the Maryland House and the Chesapeake House are only about 20 miles apart. Chesapeake House is located near Perryville, Md.. The information center was in the rear of the building. The traveler information area is run by the Maryland Office of Tourism. It provided information similar to that of the Maryland House, without postal, lottery, or travel board service. It did have a horizontally scrolled LED for all kinds of information. Its hours of operation are 8:30-17:00. There is a Discover America touch-screen-based kiosk that had the following characteristics:

+ Touch screen to obtain maps of the U.S. and specific cities as well as various other types of free traveler information services (e.g., attractions etc.). Information on hotels and restaurants is also provided.

+ Accept a credit card for ordering various products.

+ Telephone access for additional information.

In a subsequent follow-up conversation with the Maryland Transportation Authority, it was revealed that the kiosk provided by Discover America provides general traveler information and is in a usability testing mode right now. No real results of effectiveness are readily available. There has been a problem with vandalism on the kiosk. The telephone is frequently damaged. In the next version of the machine, the phone will be only accessible after a credit-card is inserted.

6.7.3 Delaware House

On Tuesday, December 6, 1994, members of the Loral Team visited Delaware House. Delaware House is located on I-95 between Delaware exits 1 and 3. The I-95 stretch through Delaware only

runs about 20 miles. The building was much smaller than either Maryland or Chesapeake House. The Delaware House had the normal repertoire of rest moms and restaurants. In the back of the building, the visitors' bureau runs a classic tourist information booth with brochures, official maps, and pretty pictures. There was a small travel board advertising local hotels accessible by telephone for direct connections. No information on travel conditions was available. The booth was staffed by an attendant who could provide information on routing, hotels, restaurants and attractions. Emphasis was entirely on in-state attractions.